

JUL 22 1943

# AUTOMOTIVE *and Aviation* INDUSTRIES

JULY 15, 1943

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**The Heald Machine Co., Worcester, Mass., U. S. A.**

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# AUTOMOTIVE and Aviation INDUSTRIES

Vol. 89

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July 15, 1943

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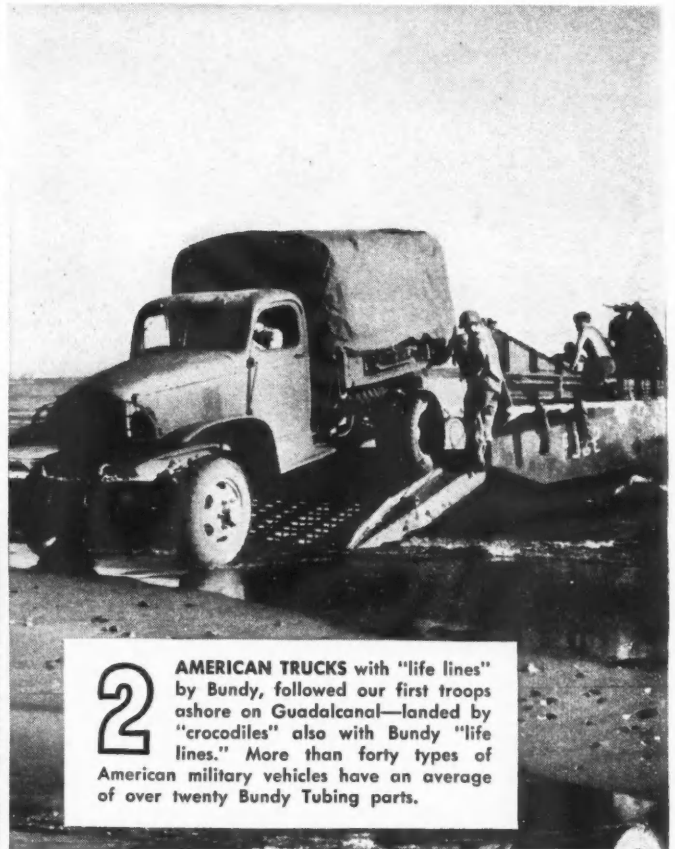


# FAMOUS LIFE LINES



**1** GUADALCANAL, important link in our South Pacific life line, is now consolidated into one of our most important island bases. Here a newly arrived detail of American troops is landing while a Flying Fortress gives protection overhead.

Official Signal Corps Photograph



**2** AMERICAN TRUCKS with "life lines" by Bundy, followed our first troops ashore on Guadalcanal—landed by "crocodiles" also with Bundy "life lines." More than forty types of American military vehicles have an average of over twenty Bundy Tubing parts.

Official Signal Corps Photograph

**G**UADALCANAL was more than a glorious victory for U. S. fighting men. It was a triumph of transport.

Against incredible odds of distance and terrain, the long life line was kept open. Men, supplies, trucks and planes were delivered at the front.

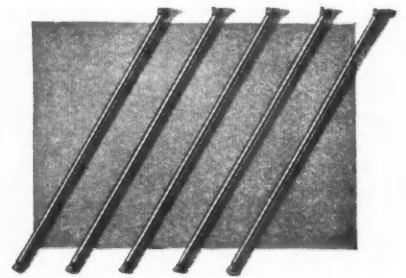
It is our job, here at Bundy, to produce mile on mile of metal tubing which plays an important part in keeping Uncle Sam's ships moving, aircraft flying, ground vehicles rolling.

Wherever pressure lines are

needed for fuel, lubrication or refrigerants—wherever hydraulic brakes are used—wherever vacuums must be transmitted—there is work for Bundy Tubing.

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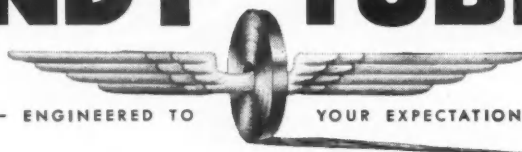
Whatever the future needs of our armed services may be, we shall do our utmost to meet them with quality and quantity. Bundy Tubing Company, Detroit, Michigan.



THESE MOTOR TRUCK PUSH RODS, made from Bundy Tubing, are holding up under strenuous service in thousands of U. S. military vehicles in every part of the world. Bundy Tubing was selected because of its light weight, strength and resistance to vibration fatigue.

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IN THIS ISSUE . . . .

## AUTOMOTIVE and AVIATION INDUSTRIES

Volume 89 July 15, 1943 Number 2

### AUTOMOTIVE INDUSTRIES

Reg. U. S. Pat. Off.

#### For the Record

The following statements are taken from a bulletin released on July 12 by Hon. Robert P. Patterson, Acting Secretary of War:

The results of the situation at the Lockland plant of the Wright Aeronautical Corporation, which is discussed in the recent Truman Committee Report, have been much less sensational than some of the inferences drawn in recently published statements. Over three months ago vigorous remedial action was taken, by the Army Air Forces.

Investigation showed that there had been a falling off in inspection procedures. Changes in the contractor's personnel and methods were promptly made. The officer serving as resident representative was forthwith removed, as was also the officer in charge of the inspection section at Wright Field, Ohio. Army inspection personnel was substantially increased. The time for engine test runs at Lockland was lengthened and other important steps of a technical nature were taken. No instance, however, was found where any engines known to be defective were ever placed in service. Failures in the engines delivered from the Lockland plant have not exceeded normal experience with engines in combat planes.

In a program of aircraft production which the Committee states "as a whole has been unequalled anywhere else in the world," it is understandable that problems should arise.

In the war emergency, Curtis Wright has responded to every call made by the armed forces, and its performance on the whole has been creditable.

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**U.S.  
WAR BONDS**

#### Training Aircraft Engine Mechanics

17

For every bomber, transport or fighter plane that comes off the lines, 10 to 20 skilled ground crew men must be ready to keep that plane flying. More than a million of these trained aircraft mechanics, it is estimated, will be in the AAF when it reaches its presently anticipated full strength. What four automobile manufacturers are doing to train men on a mass production basis for this service is told by E. L. Warner, Jr.

#### It Could Be the Germans' Submarine Diesel

19

A 12-cylinder, 36 deg., V-type Diesel engine of the marine type and operating on the two-stroke cycle, developed by Klockner Humboldt Deutz A.G. of Cologne is described and a graph, showing power and fuel consumption in relation to rpm, is presented as the result of the efforts of AUTOMOTIVE AND AVIATION INDUSTRIES' British Correspondent. It's an interesting engine and may be one of the many reasons for the repeated bombing of Cologne.

#### Chevrolet's New Aluminum Forge Plant

20

Starting from scratch not so long ago, Chevrolet is now producing controllable pitch airplane propeller blades, crankcase covers for Pratt & Whitney engines, airplane pistons of forged aluminum, propeller hub pistons and links for landing gears in a brand new plant equipped with the latest types of forging and metallurgical treatment equipment. How it is done and with what it is done are told by Joseph Geschelin.

#### Douglas Streamlined Inspection System

24

The problem of maintaining peak quality inspection standards under conditions of tremendously expanded aircraft output was solved at Douglas by the method here described by C. C. Harrison, Chief Inspector of the Douglas Long Beach plant. Results—need for fewer highly trained inspectors, marked elimination of production delays due to confusion over quality requirements.

#### More P-38's from Mechanized Assembly Line

32

Production of Lightning P-38 fighters, within 60 days after a change over to a continuously moving mechanized assembly line, is expected to be doubled over the daily output of the old line. By this innovation, Lockheed takes a leaf out of the book of the automobile manufacturers even renting for the duration equipment from the Southern California Division of General Motors.

#### Making a Diversity of Rings for War Machines

36

Here is a thoroughly comprehensive article dealing with the methods, processes and "know-how" by which the Koppers Company, American Hammered Piston Ring Div. produces an enormously varied line of rings for airplane engines, motorized vehicles, Victory ships, and many types of industrial equipment in a wide range of sizes, of cast iron, bronze and the Gold Seal line of cast iron rings with bronze inserts.



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# RYERSON STEEL-SERVICE

# AUTOMOTIVE and AVIATION INDUSTRIES

Published on the 1st  
and 15th of the month

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July 15, 1943



*AAF trainees study  
the critical settings  
on the Packard-built  
Rolls-Royce engines  
at the Packard Air-  
craft Engine School.*

## *The Automotive Industry's*

# Training of Aircraft Engine Mechanics

*By E. L. Warner, Jr.*

**F**OR every bomber, transport or fighter plane that comes off the assembly lines of the aircraft industry, the Army Air Forces Technical Training Command must have 10 to 20 skilled ground crew men ready to keep that plane flying. With U. S. industry scheduled to produce 100,000 planes in 1943, a large proportion of which will go to the Army Air Forces, the magnitude of the personnel training program confronting the AAF can be appreciated. When the AAF attains its ultimate goal of 2,200,000 men, it is estimated that more than 1,000,000 of them will be aircraft mechanics.

"A plane that cannot fly is one of the most useless things in the world," says Maj.-Gen. Walter R. Weaver, commanding the AAF-TTC. "And planes will not fly unless they have sufficient ground crews for their proper maintenance. There is a strong relationship between the training of pilots and the training of equally heroic ground crews. When a plane takes flight it is all-important that the men who conditioned the ship before it left the ground were skilled, thorough, dependable and, further, that the ship will not fail because of the ground crew's inefficiency."

Helping mass produce the thousands of mechanics that are needed to service America's growing air

armada are four automobile manufacturers that also are engaged in the production of aircraft engines. Buick, Chevrolet, Ford and Packard all have converted part of their sales and factory training personnel to the instruction of AAF recruits in the intricacies of aircraft power plants.

However, before the AAF recruit comes to Detroit for the specialized course in aircraft engine maintenance, he is assigned to one of the basic training centers of the Technical Training Command for an indoctrination course and general instruction in airplane theory, structures and types of engines. The basic training centers are located at Jefferson Barracks, Mo.; Keesler Field, Miss.; Sheppard Field, Tex.; Miami Beach, Fla.; Atlantic City, N. J.; St. Petersburg, Fla.; Kearns, Utah; and elsewhere. Each recruit is acquainted with the score of occupations in the AAF ground forces, after which he can state

his first three preferences as to specialization. Then the recruit undergoes a series of aptitude tests, each ranging from 30 minutes to two hours, to determine for what specialized field he is best fitted. These tests, together with the recruit's occupational background and the general classification test, probably will determine his next training destination after completing the basic course.

Ford Motor Co. was the first of the automobile manufacturers to undertake the training of mechanics for the AAF. In February, 1942, Ford assigned instructors from the Ford industrial schools to teach AAF recruits a 12-week basic course in aircraft engine maintenance. Classrooms were located in the front section of the new Pratt & Whitney Airplane Engine Building at the Rouge plant. In September, 1942, a short advanced course on the Pratt & Whitney 2000-hp engine which Ford manufactures was added to the curriculum. Trainees in this course receive their basic training elsewhere or have equivalent practical experience. They are given intensive instruction in sub-



*Completely dismantled engines are reassembled two or three times during the course at the Chevrolet school. Every man who graduates must be able to service the more than 6000 parts that go to make up the Pratt & Whitney engine.*



*(Above) Students from the Technical Training Command work on a Pratt & Whitney 2000-hp engine on an engine stand at the Ford aircraft mechanic training school.*

*In this shop-classroom at the Buick school for training Army Air Force mechanics, soldier-students tear down and re-assemble the blower section of powerful bomber engines.*



assemblies, accessories, including the supercharger, engine overhaul, operation and test. They also spend a few days in the factory observing the manufacture of the big engines in order to familiarize themselves with their design and construction. The future mechanics also watch the testing of the engines and the elaborate readings taken in the nearby test cells. In the use of maintenance tools they are taught to improvise in order to become used to field operations.

Ford has 29 instructors, recruited from among former automotive field service men, public school teachers and mechanics, who conduct the classrooms for the AAF personnel. A text for the course is being prepared by the Ford aircraft school based on the AAF

*(Turn to page 98, please)*



# New German Marine Engine

SOME information has become available regarding a new Diesel marine engine developed by the Klockner Humboldt Deutz A.G., Cologne, a firm whose output of Diesel engines is considerably greater than that of any other concern in Germany. A 12-cylinder 36-deg V-type operating on the two-stroke cycle, it is stated to have passed all tests (including 700 hours running with 400 hours non-stop) and to have been put into production. Details, so far as they are known, have been published in *The Motor Ship* (London) and the following particulars are taken therefrom. A belief that this new Deutz engine is being or will be used in U-boats awaits confirmation, which was sought, but could not be obtained from the British Admiralty by the London correspondent of *AUTOMOTIVE and AVIATION INDUSTRIES*.

Hitherto, the majority of Deutz engines have operated on the four-stroke cycle and, for marine propulsion, only moderate speed units have been built. The new engine, however, has a speed of 700 rpm, at which 1200 bhp is developed, and the adoption of the two-stroke principle indicates the trend of ideas in Germany. The Vee design is, moreover, novel for engines of this class.

In developing the new engine it was conditional that materials such as light alloys and special steels should be utilized to the least possible extent and that the advantages it was desired to secure should be obtained by development of the normal two-stroke engine in combination with higher crankshafts speeds.

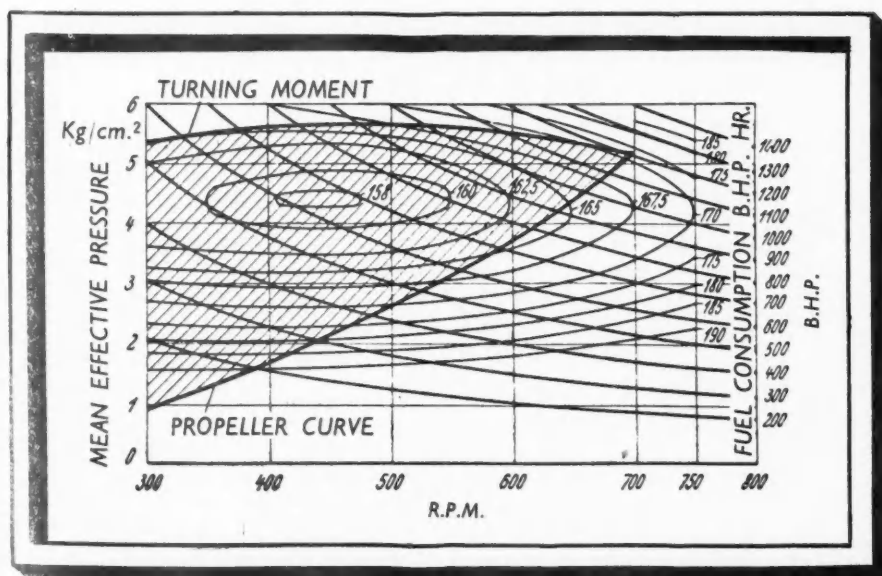
Previously, the only Deutz two-stroke marine engine was one brought out in the fall of 1939. It was, how-

ever, of conventional design, intended only for units up to 500 bhp and a maximum speed of 500 rpm. It was an in-line six cylinder with a bore and stroke of 240 by 360 mm.

The new engine, with its two banks of six cylinders set at 36 deg, has a bore and stroke of 220 by 300 mm. As stated, the normal speed is 700 rpm, at which it develops 1200 bhp. It is designed to run down to speeds as low as 100 rpm. The mean effective pressure at full load is 5.1 kg per sq cm, or about 72 psi and the piston speed is 7.7 mm per sec. or 1520 fpm. The weight with auxiliaries is given as 5.8 kg per bhp, which is slightly under 13 lb per bhp.

The engine is a self-contained unit with all auxiliaries either directly or indirectly driven from the crankshaft. These auxiliaries include the scavenge pump, injection pumps, lubricating oil pumps, circulating water pumps and general service pump. The lubricating oil tank, coolers and filters are also attached to the engine, so that when it is being installed it is merely necessary to make the various connections for water, lubricating oil and fuel oil. The scavenge blower is driven by spur gearing from the crankshaft and is of the centrifugal type. The mep of 72 psi indicates that the engine is not supercharged, but the possibility of adopting this plan in the future, with correspondingly increased output, is believed to be in the minds of the makers.

The crankshaft, of 70-ton steel, is carried in seven lead-  
(Turn to page 150, please)



Graph showing power and fuel consumption in relation to speed of revolution for Deutz two-stroke engine.

# *Latest Type of Equipment at* **Chevrolet's New Forge**

**A**CCENTING its wartime contributions in the field of non-ferrous metal processing, Chevrolet has scored another advance by the introduction of its new aluminum forge plant. Starting from scratch, Chevrolet has commissioned a new building, equipped with the latest types of forging equipment. The experience gained from steel forge operations serving a million-car-year program of peacetime has stood in good stead in overcoming the problems posed by aluminum forging. Although lighter than steel and lower in physical properties, aluminum is considered more difficult to handle, possibly because of a paucity of mass production experience.

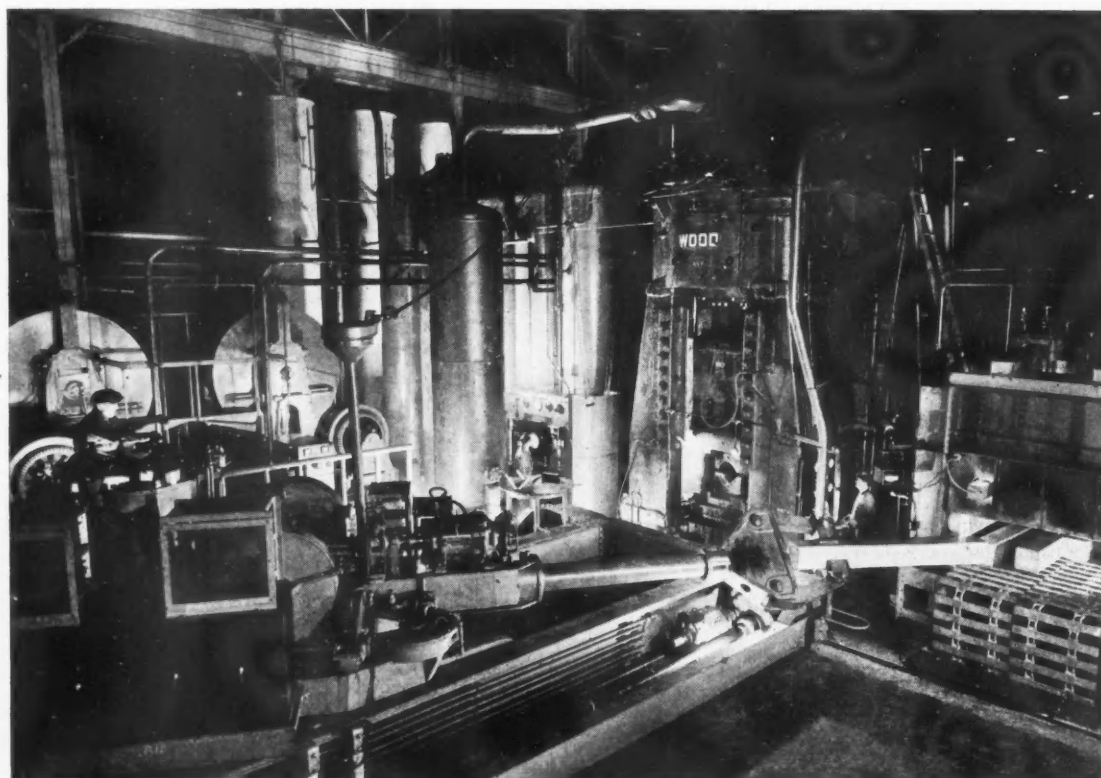
In any event, aluminum, requiring about three times the hammer capacity of comparable steel forgings, works havoc with even the finest die steels that are available. In addition, aluminum requires special metallurgical treatment for the development of its physical properties. These and other considerations unique to the processing of aluminum are reflected in the procedures and character of equipment found in this plant.

At the present writing, the Chevrolet Aluminum

Forge is producing propeller blades for controllable-pitch airplane propellers, crankcase sections and crankcase covers for Pratt & Whitney airplane engines built by Chevrolet, forged aluminum airplane engine pistons, propeller hub pistons, and links for landing gears. Doubtless the list of parts will be greatly extended as time goes on.

Serving the forge plant proper is a well equipped die shop replete with heavy duty machinery such as Cincinnati Hydro-Tels, Norton cylindrical grinders, and other makes and types suitable for die shop requirements. Within a short time this plant will be practically self-sufficient with respect to tools and dies for its use. In addition, there is a maintenance department well outfitted with large LeBlond lathes and equipment suitable for the repair and operation of production machinery.

To cope with the metallurgical problems involved in the forging of aluminum, this plant boasts one of the finest laboratories to be found in the industry. Here will be found a complete "wet" chemical laboratory, a microscopic department, spectrographic department, General Electric X-ray equipment, and a large



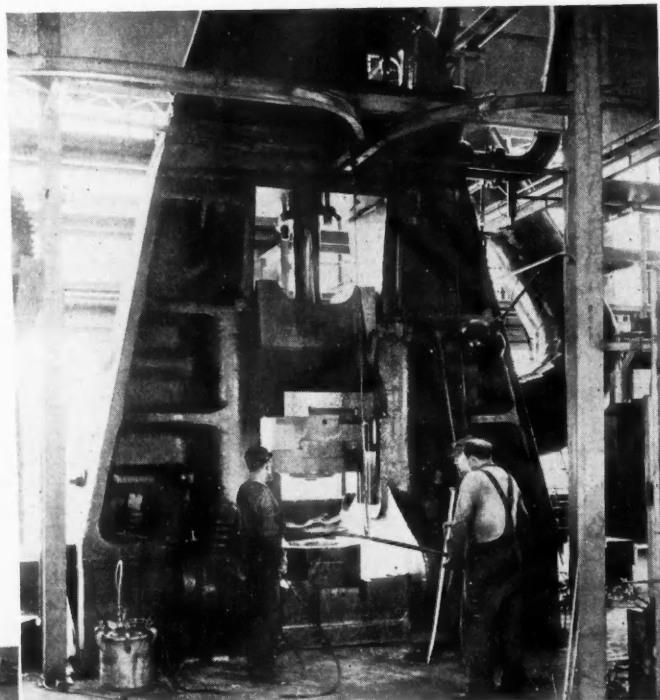
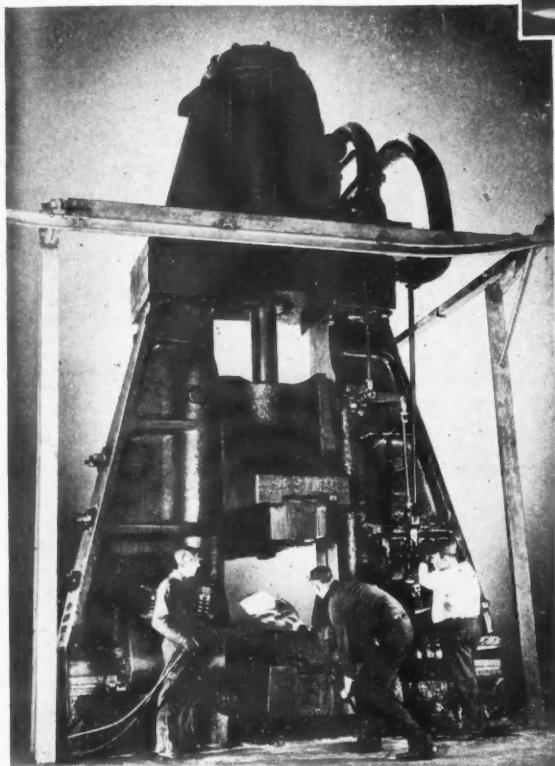
*Impressive sight is this huge 3000-ton Wood press which is used for reducing large ingots; and for producing crankcase biscuits. In the background is the imposing array of accumulator system bottles and auxiliaries. In the foreground is the versatile manipulator, shown in the act of removing an ingot from the pre-heating furnace and about to carry it to the press.*

# e Plant

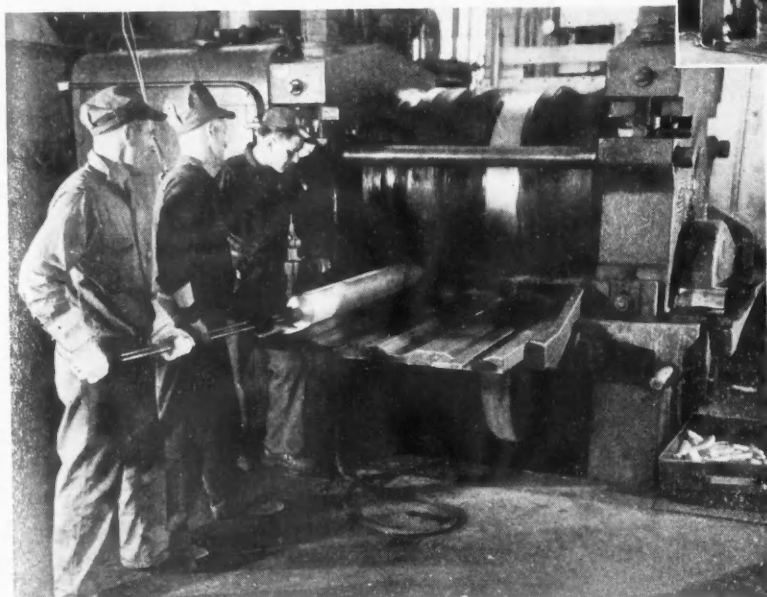
By Joseph Geschelin



(Above) The big billets for crankcase forgings are cut into sections of proper size on this heavy duty 84-in. Tannevitz band saw.



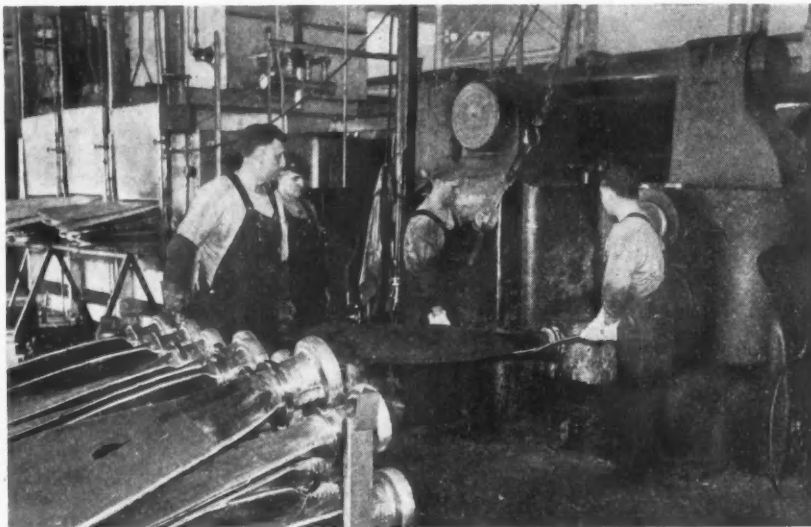
(Above) Gigantic 20,000-pound Chambersberg hammer is shown completing the forging of a crankcase section.



(Above left) One of the largest single pieces of equipment at Chevrolet is this towering 35,000-pound Erie hammer. One of its jobs is to forge the propeller blade.

(Left) Following scalping, and in preparation for forging, the propeller blade stock is formed and flattened at the blade end in this No. 5 Ajax roll.





*Swedging of the hub end is done on one of the 7½-in. National forging machines. For this operation, an operator slips two bearing races over the open end so that after swedging the bearing races are left loosely mounted between the hub end and the blade.*

physical testing lab. One of the functions of the latter is to perform routine tests on propeller blade specimens, running a complete schedule of tests on one sample out of each ten. Among the items of equipment in this department is a large Baldwin-Southwark tensile testing machine.

Plant equipment is imposing in size and character—large steam hammers, huge upsetters, forging presses, trimming presses, heat treating furnaces, lathes, cut-off saws, and an impressive 3000-ton hydraulic press. To cover this variety of equipment briefly, we may note the following specific examples:

Two Ross System ovens for aging treatment, running 175 ft in length.

Two Electric Furnace solution treatment furnaces.

E-F roller hearth furnaces for solution treatment.

Six pit-type Electric Furnace units.

Four 35,000-lb Erie steam hammers.

Two 12,000-lb Erie steam hammers.

Two 8000-lb Erie steam hammers.

Four 20,000-lb Chambersburg steam hammers.

Two 16,000-lb Chambersburg steam hammers.

Twelve #8-60 Bliss presses for trimming forgings.

3000-ton R. D. Wood hydraulic press

with auxiliaries.

Two 8-in. Ajax upsetters.

Two Ajax #5 rolls.

A 1300-ton and a 1600-ton Ajax press.

Two 7½-in. National upsetters.

A #3 and a #6 Maxipress.

Five Lodge & Shipley Duomatic lathes for scalping blade forging stock.

Six Campbell abrasive cut-off machines.

Six Tannewitz band Saws for trimming blade flash.

Eight Surface Combustion chain conveyor convection heating furnaces.

Fifteen Industrial Equipment heating furnaces.

Perhaps the best way to visualize some of the activity is to examine the steps in the processing of several of the forgings, say the propeller blade and the crankcase. Consider the blade first. Raw material for the blade comes in the form of long rolled aluminum bars. These are cut to length on the Campbell abrasive cut-off saws and are centered with a portable hand tool.

*Part of a battery of Industrial Equipment heating furnaces, this group handles pre-heating for upsetting in the National forging machine.*

The centered bars then are delivered to the battery of Lodge & Shipley Duomatic lathes for scalping—removal of a heavy cut on the OD—also for turning down one end to serve as a tong hold.

At this point it may be well to mention that all rolling or forging operations are preceded by heating of the bar or billet to 850 F in one of the service furnaces.

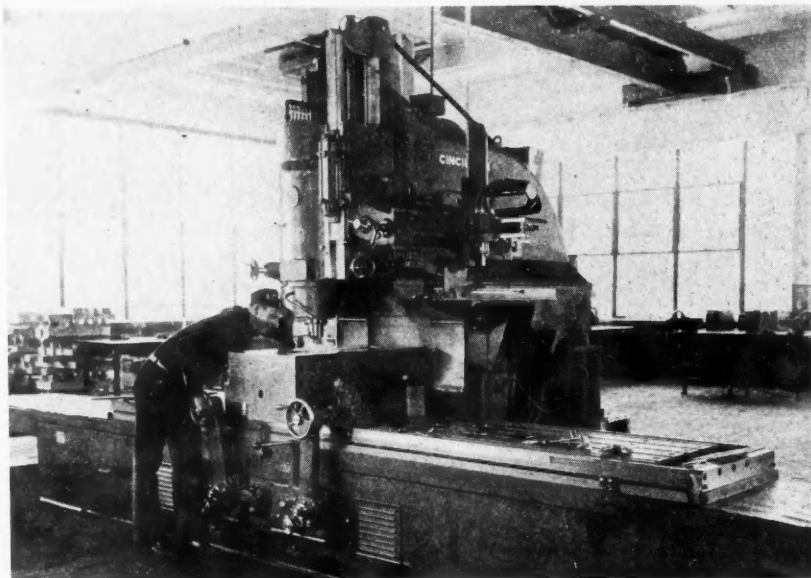
Next operation is the flattening of the blade end in one of the #5 Ajax rolls, thus preparing the billet for the hammers. Then the blade is forged in the large Erie 35,000-lb hammer. Flash is removed on a Bliss Press and Tannewitz band saw which also is used for cutting off the tong hold. Incidentally, the tong hold from each blade is used as the test piece and follows the blade through its cycles of forging and heat treatment, prior to delivery to the lab.

At this stage the blade forging is practically complete save for swedging of the hub end. For this operation, the hub end of the forging is heated to 850 F, then the operator slips on two bearing races. The hub end is upset and gathered in one of the 7½-in. National forging machines, leaving the bearing races loosely mounted between the hub end and the blade.

Final stage is that of heat treatment. First the blade is given the solution treatment in one of the Electric Furnace units; this treatment holds the blades



*This Cincinnati Hydro-Tel is an example of the modernity of equipment provided for the tool room.*



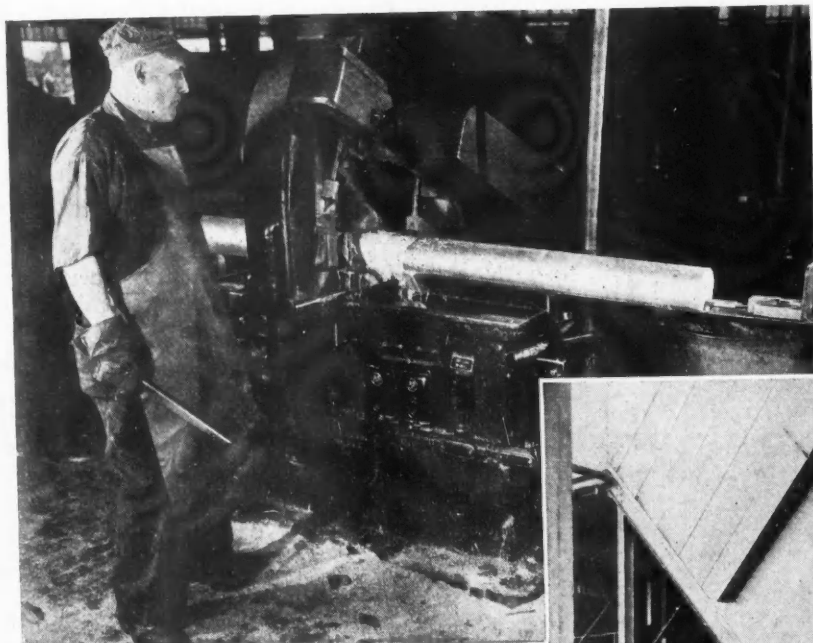
at 960 F for 6 hours full heat, in a 12-hour cycle, followed by quenching in hot water. Aging treatment of the blade is handled in the mechanized Ross furnace which is 175 feet in length, holding the work for 16 hours, 8½ hours at full aging temperature.

Miscellaneous forgings are given solution treatment in another battery of Electric Furnace units. Aging treatment is given in a Ross Unit mounted parallel to the furnace used for aging the blades. The battery of Surface Combustion chain conveyor connective heating furnaces is used for large billets prior to forging.

The crankcase forging is produced by a unique process. Raw material is received from the Aluminum Co. of America in the form of cast aluminum billets, 12-in.

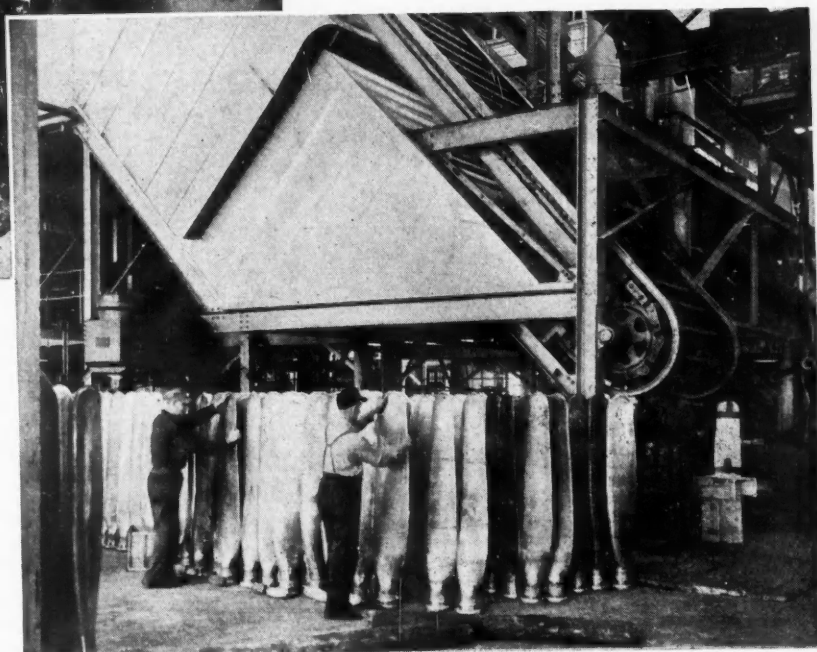
square. These are reduced to 9½-in. round cornered squares in the Wood forging press, to be described later. The resulting billets are cut into short blanks on a large 84-in. Tannewitz band saw, the ends then being polished and ground by hand to remove all tool marks.

The small billets are now forged into circular biscuits on the same Wood press, the formation being done in a single stroke. They are re-heated to 850 F in preparation for this operation. The biscuits, in turn, are blocked or rough-forged in a 20,000-lb. Chambersburg hammer, finish-forged on the same type of hammer. On some  
(Turn to page 94, please)



*(Above) In preparation for the scalping operation, propeller blade forging stock is cut to length on one of a battery of Andrew C. Campbell abrasive cut-off saws.*

*(Right) Close-up of one end of the Ross System aging furnace which is traversed by a mechanized conveyor. This unit consists of two parallel furnaces, one for propeller blades; the other for miscellaneous forgings.*



# Douglas Streamlined

INSPECTION CARD									
Long Beach PLANT CARD No. 1 of 3									
MODEL B-17F		DEPT 542		NAME OF ASSEMBLY Fuselage Sta. 6-11					
ORDER 550		POSITION OR JIG No. 42		FACTORY No.					
ITEM NO.	P. I.	OPERATION	SECH No.	LEADMAN'S SIGNATURE	DATE	CO INSP.	DATE	GOV INSP.	
1.		Pickup 4-136151-13 55-7612							X
		Loc: 7 to 11 entire section	X	X	X	X	X	X	X
		(A.) Check all installations.				X	X	X	
		(B.) Check for cracks, bad rivets & clearances				X	X	X	
		(C.) Check all bolts for length, check condition of nuts.	X	X	X	X	X	X	X
2.		Plates 24-136151-14 6-2212							X
		On top outside, fwd & aft side of bl. 49	X	X	X	X	X	X	X
		(A.) Check location & installation				X	X	X	
		(B.) Check 27/64 holes through terminals & plates.	X	X	X	X	X	X	X
3.		Plate 24-136151-14 3-13573							X
		Loc: On top outside, fwd side of bl. 50	X	X	X	X	X	X	X

Typical inspection card listing detailed instructions.

ONE of the many production difficulties incidental to the tremendously increased expansion of American aircraft industry was the problem of maintaining peak quality inspection standards with the utilization of inexperienced personnel lacking pre-training in industrial fields. In many cases relatively inexperienced leaders had been rapidly upgraded to fill key posts. Potentially it was possible to visualize a lowering of inspection standards as a result.

With the inauguration of one of the larger Douglas California plants, it was quickly recognized that limited numbers of experienced inspectors available could not cope adequately with accelerated production schedules, at the same time continuing to provide satisfactory quality control. Though trained and experienced personnel in small numbers were transferred from other Douglas plants to fill many key supervisory spots, a sizeable percentage of inspection personnel had to be recruited. Educational programs were conducted and they relieved the situation to a certain extent, but due to the exacting nature of inspection work, it was found impractical to train incoming personnel in a short time in the complicated and precise knowledge required for regular inspection duties. Major training features undertaken by the company gave personnel only basic rudiments of the job. These rudiments seem quite different from an inspection standpoint compared to the customary five years or more experience required of inspectors on whom the company had relied to maintain quality control in the plant. Inspection heads noticed particularly that the apprentice inspector was prone to miss important details, most particularly being at a loss to proceed in exceptional or unusual cases. At that time there was no comprehensive operational planning for inspection routine. Experienced inspectors instinctively look for spots where trouble has previously been known to

exist, whereas apprentice inspectors under ordinary circumstances are "groping in the dark."

It, therefore, was decided to formulate an inspection system which would clearly define, on a centralized inspection form, all detailed instructions necessary to control quality (see illustration). Methods of fixing responsibility and reducing inspection time were introduced by requiring preliminary inspection and sign-out by the production leadman in charge of the particular assembly operations involved. In some instances inspection actually

was replaced by production sign-off when inspection could be accomplished with other installations at a subsequent inspection station. Such practice in no way reduced quality of individual items or waived inspection department responsibility for maintenance of quality standards. In general, sub-standard items located by production leadmen were those which in subsequent operations would receive complete inspection checks.

Definite dangers presented themselves in following this practice, necessitating rigid protective measures. Instances occurred in which leadmen signed out items without proper check; confusion also resulted as to specific types of item which such leadmen were authorized to give preliminary check. To overcome all such contingencies, the Inspection Department established the following additional provisions.

A. That a "Quality" stamp be assigned each production leadman responsible for check-up, properly numbered to denote the leadman. Control of quality stamps by the main office of the Inspection Division forced each leadman to protect his working status by accurate check prior to sign-out of inspection forms. If quality were not maintained, his own quality stamp would be subject to recall and authority to exercise sign-out responsibility cancelled.

B. The Inspection form was drafted to indicate specifically where production leadmen's stamps were acceptable. Quality leadman stamps were necessary on all items prior to submission of the form to inspection. This eliminated necessity of submitting items to be inspection-checked in subsequent operations. Ultimate objective is to eliminate inspection checks as soon as it can be demonstrated that production sign-off is dependable for that specific item. In the interest of quality control, inspectors spot check periodically. This practice reduced inspection personnel volume, per-



# Inspection System

## Speeds Production

By C. C. Harrison

Chief Inspector of Long Beach Plant  
Douglas Aircraft Co.

mitting favorable concentration of highly specialized personnel. It also served to force production departments to a high degree of quality consciousness, thereby accelerating production by cutting inspection time.

As a further move toward control, inspection cards are printed in specific colors denoting types of manufacturing operations. Color banding is used thus:

- A. Sub-Assembly—brown.
- B. Fuselage Installation—green.
- C. Wing—tan.
- D. Final Assembly—yellow.
- E. Field Operations, etc.—red.

By such banding, control is exercised for complete clean-up within each color zone. For incomplete items the inspection card continues to flow with the unit until installation is complete.

Inspectors are instructed to do everything possible to urge clean-up of incomplete items in the specified position, or at least before the unit leaves its color zone.

(Turn to page 92, please)

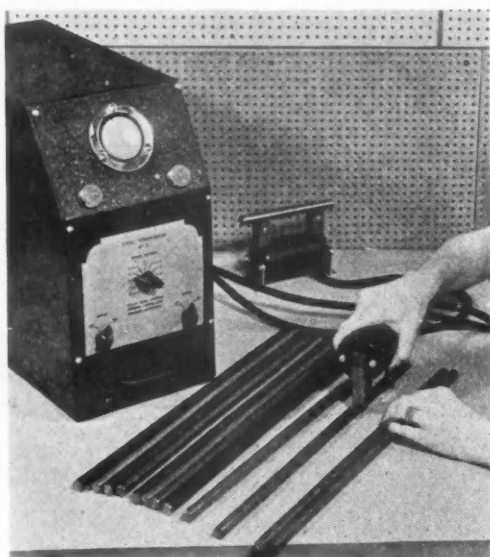


Corrections needed are indicated in the preliminary inspection (P.I.) column of the Inspection Card (left). "E" designates an engineering item, instructions for which and its disposition being listed on the reverse side of the card as shown below.

INSPECTION CARD		Long Beach	PLANT ASSEMBLY	17-16-1 (1)
MODEL	DEPT	512	NAME OF ASSEMBLY	CASE NO.
ORIGIN	POSITION OR JIG NO.		FACTORY	
P.I.	OPERATION	MECH NO.	LEADMAN'S SIGNATURE	DATE
1. E	OK TO INSTALL AUXILIARY TANKS	5/1/23	22	5/27/43
	Check: A. Chafing strips inside wing.	5/1/23	22	X
	B. Taped felt on gussets & rubberized covering on all protruding rivets.	5/1/23	22	X
		X	X	X
2.	OK TO INSTALL NO. 1 TANK & GAS CAP			X
	Check: A. Ties on No. 1 tank for square knots			X
	B. Wasket under gas strainer			X
	C. Cap & lid and seal			X
3.	OK TO INSTALL NEXT 4 TANKS			
	Check: 1. On each tank for square knots.			
	B. Inside of tanks for dirt.			
4.	OK TO INSTALL TANK COVERS, BONDING BRAYS & VENT PIPES			
	Check: A. Seals on tank covers.			
	B. Bonding			

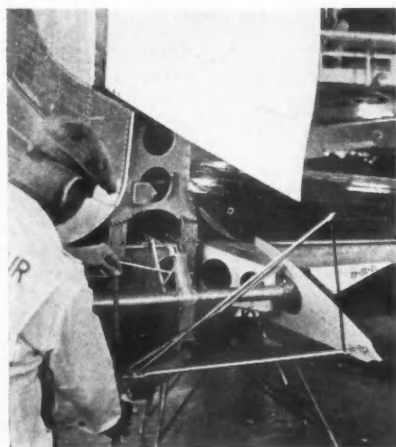
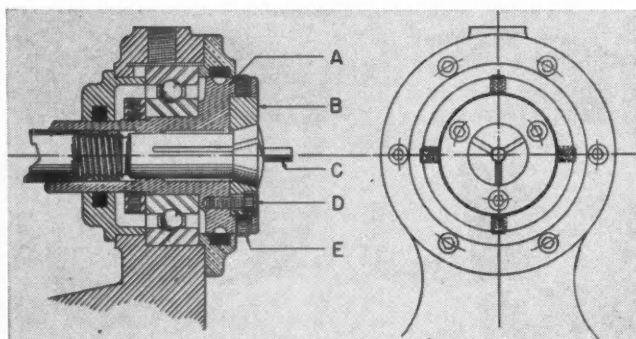
ITEM NO.	ENGINEER'S ITEM NO.	NO OF PICK-UP ITEMS	REMARKS	CHECKED BY INSPECTOR
1	E	(1)	NO LARGE TEAR IN FABRIC OF NUMBER 4 AUXILIARY FUEL TANK.	
			Hold for Structural representative	
			H. H. Kamm	
			7-20-43	
			Tank patched and OK for installation.	
			G. H. Kamm	
			Structural Representative	

# Short

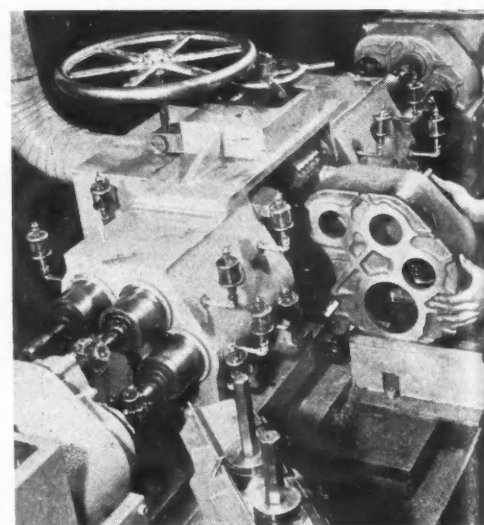


(Above, left) This Steel Comparator, an electronic machine developed by Delco-Remy research engineers for making a quick check of the compositions of steels, not only saves time and reduces cost as compared with the chemical analysis method, but also almost any employe can be trained within a short time to do the job efficiently. Wired to the cabinet, which houses the cathode ray and amplifier controls, are two fixtures—one that is stationary for holding the piece of steel of known analysis, and the other movable for holding the steel to be tested. If the picture on the end of the cathode ray oscillograph tube is a straight horizontal line, the pieces are of identical analysis. Any other figure means their analyses are different. The only limitation to turn up so far is that the standard bar or part must have the same cross-section as the piece being tested. Controls consist of an on and off switch for the indicator, a bridge on and off switch and a variable resistor for balancing the instrument. On one emergency inspection job on the production line, this magnetic method is estimated to have saved the company about \$5000.

(Below) By replacing the regular bench lathe spindle by a "bell end" spindle and incorporating a central disk in which the taper portion of the collet seats, practically perfect concentricities are obtained by General Electric in machining tiny parts for meters and instruments. The changes are made without altering the effective length of the spindle or draw bar. As shown by the drawing, A shows the bell end of the spindle; B is the disk which receives the collet C; D indicates the three screws which hold the disk fast after four screws E have been used as jack screws to adjust the collet to concentricity. The arrangement is adjusted easily by grasping a plug of the collet size and applying an indicator to it.



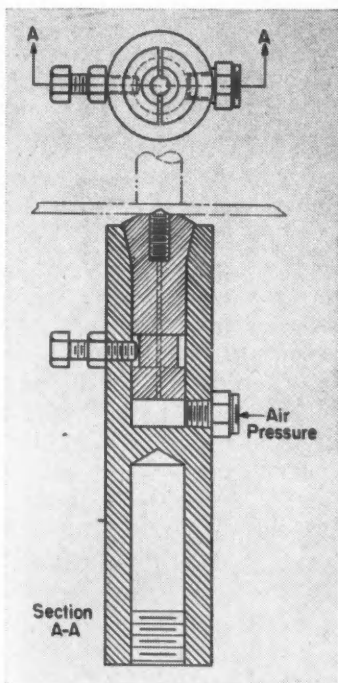
(Left) Here is a jig used by United Air Lines at its central maintenance base at Cheyenne, Wyo., to obtain more accurate measurement in rigging of elevators and rudders than was possible by former methods. The jig consists of two 1020 steel plates of .125 in. thickness attached to the elevator torque tube bearing supports on the airplane's stabilizers and braced in between with four pieces of 5/16 in. tubing. The device allows for the checking of one elevator against the other and determines the setting against the center line of the stabilizers. The setting of elevator and rudder stops can be accomplished with ease.



(Above) Chevrolet engineers converted an idle horizontal drill into this special transfer case-boring machine by using two previously produced Chevrolet transfer cases for boring heads and connecting them to the fixture by eight passenger-car universal joints. The plant's transfer-case output was increased almost 60 per cent. The unit was completed in two months against the six to eight months needed for delivery of the special tools needed to do the job, and scheduled delivery dates for Army trucks were met.

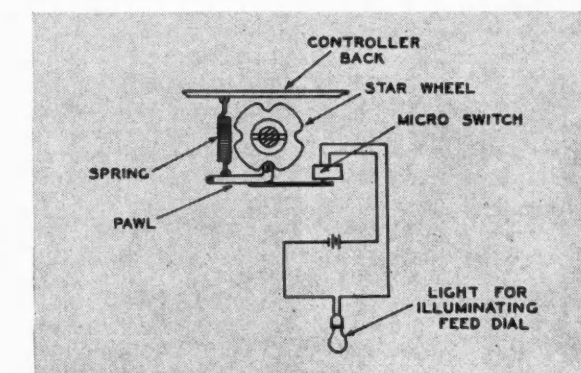
# Cuts

(Below, right) At the main aircraft plant of the General Motors Fisher Body Division a 17 per cent saving of time has been accomplished in the wiring of stabilizers by tying a knot on the end of a string and then blowing it through the conduit, after which the operator can easily pull the wires through from the other end. Before a piano wire was pushed through the conduit, but this method proved to be quite slow at times due to sharp turns.

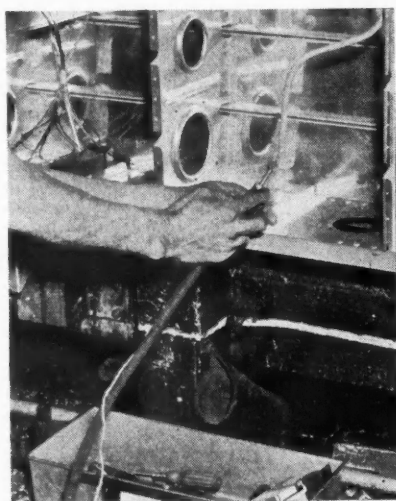


(Left) This electrode, a General Electric development that is said to make practically foolproof the projection welding of studs on metal hinges and sheet metal surfaces, calls for a vertically milled slot in the tapered collet in the bottom electrode. Then as the upper electrode is depressed, the jaws of the collet close tightly about the stud. The resulting pressure causes the current to be distributed evenly on all sides, and at the top of the stud near the welding zone rather than through the entire stud and then to the sheet. Below the collet is a space for air, forced in under pressure from a hose. As soon as the welding is complete and the upper electrode lifted, the air pressure forces the tapered collet upward to release the stud. When the collet reaches a height sufficient to release the stud, its movement is stopped by the setscrew.

(Right) Some drill presses are equipped with an illuminated dial which shows the speed at which the drill is operating. The controller, by means of which the speed of the drill is changed, is operated through a flexible shaft by means of a handle on the front of the drill press near the spindle. Owing to the fact that flexible shaft is quite long, unskilled operators often are unable to feel the proper engagement of the controller. At the Bell Aircraft Corp. a switch is provided in the circuit of the lamp illuminating the dial, which is automatically operated in such a manner that the light will be lit only when the controller is properly engaged. This prevents the motor from running with one phase open, thereby preventing burn-outs. The switch is operated by the pawl engaging into notches on the star wheel.



(Above) The special wrench shown here is used for holding conduit couplings while the collars are being tightened and was devised at the Consolidated Vultee Aircraft Corp. It is especially applicable where conduit is being run through a bulkhead or hull. It replaces an extra man who otherwise would be required to hold the coupling on one side of the bulkhead while the collar was being put on and tightened from the other side. In using this holder, the coupling is put through the bulkhead hole, the wrench is slipped through the coupling, the workman then goes to the other side of the bulkhead, slips the collar over the wrench handle and holds the coupling while tightening the collar. The wrench is then backed through the coupling. Wrenches of this type should find extensive application where electrical, hydraulic, heater and Sperry installations are being made.





# Basic Principles of X-Ray

By Robert Taylor

Supervisor, X-Ray Inspection Control Laboratory, North American Aviation, Inc., Dallas, Texas.

**A**LTHOUGH radiography will uncover defects of small magnitude in material specimens, it is not ideally suited to an experimental analysis of the constitution of matter. For this purpose the diffraction method is used, which makes it possible to peer into the very structure of matter and study the arrangement of molecules.

If crystals are built up of atoms and molecules marshalled in definite rows and in parallel planes, with their mutual forces restraining them to relatively-fixed positions in the rigid solid, and if X-rays are scattered by atoms, then these crystals are potential three-dimensional diffraction gratings for X-rays.

Such was the conclusion reached by Laue, in 1912, after he had accepted the work of Schoenflies and Federov leading to the conception of space groups and had calculated from the density, molecular weight and weight of the hydrogen atom that the distances between regularly-disposed particles of mass in crystals must be of the same order as the wave of X-rays ( $10^{-8}$  cm).

It took more than fifteen years to discover that all solid crystals are perfect three-dimensional gratings for X-rays, by virtue of the fact that they are built in remarkably organized fashion, with the atoms lying on equidistant parallel planes whose spacings are of the same magnitude as X-ray wave lengths. Since every crystal conforms to a very characteristic architectural plan, depending on the kind and number of

atoms, the diffraction pattern registered on a photographic film by a fine beam of X-rays passing through a specimen, will be characteristic of the material. Thus if the wave length of the X-ray is known, as is usually the case, then the actual structure of a crystal acting as a grating may be deduced. Since the information involves the position in space of atoms to form a solid, we are thus employing X-rays to

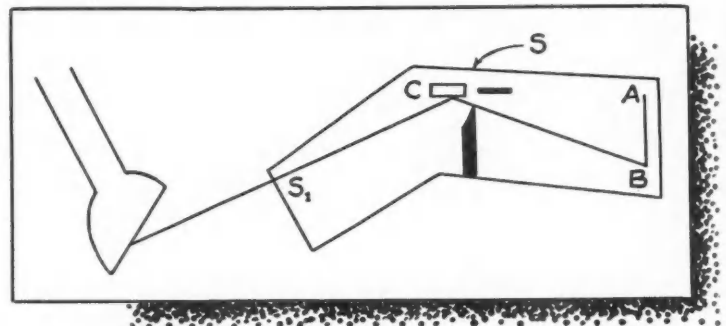


Fig. 2—Seeman X-ray spectrograph.

“look” down into the fine structure of matter far beyond the powers of any microscope.

It is possible to analyze not only single grains but also extremely fine-grained aggregates. Even liquids, which are usually classed as truly amorphous, produce diffraction interference, indicating some kind of ordered arrangement of molecules even though this may be transitory. There appears to be no limit to the kinds of matter which can be examined in this super-microscopic sense, though the more distinctly crystalline the material, the simpler the interpretation.

Diffraction has afforded the chemist a powerful and new fundamental tool in the solution of some of the most difficult problems.

The original analysis by Laue was of considerable mathematical complexity, but the Braggs were able to reduce the interaction between X-rays and crystals to terms of great simplicity, by considering primary X-rays to be reflected by the face of a crystal.

Referring to Fig. 1, if we take a columnated beam of X-rays and direct it at the surface of a crystal at a certain angle, a maximum intensity of deflection is obtained. Let the points A, A', A'', A''', represent molecules in various equally-distant planes. When a beam of X-rays strike A, X-rays are emitted in all directions. As a beam strikes A' X-rays are also emitted in all directions, but those in a line and in

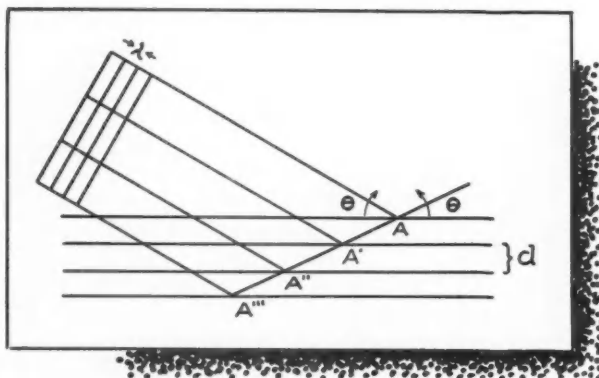


Fig. 1—Section perpendicular to any set of planes on which the atoms of a crystal are distributed. A, A', A'', A''', atoms in successive planes; d, distance between planes;  $\lambda$ , wave length of X-rays used;  $\theta$ , angle of incidence;  $\lambda = 2d \sin \theta$ .

# Diffraction

phase with the X-rays from *A* yield a consequent beam of increased intensity. The same takes place with *A''*, *A'''*. Therefore, when a beam of X-rays is reflected from the face of a crystal, it is found that the angle at which reflection becomes evident bears a simple relation to the wave length of the X-rays used, and to the distance between the adjacent layers of atoms in the crystal. This relationship is as follows: the distance between adjacent planes of atoms is equal to the wave length of the X-rays divided by twice the sine of the angle of incidence. It follows then that, if either the wave length of the X-rays or the distance between the planes of the crystal is known, the other factor can be determined.

The crystal spectrometer originally designed by W. H. and W. L. Braggs is a device upon which crys-

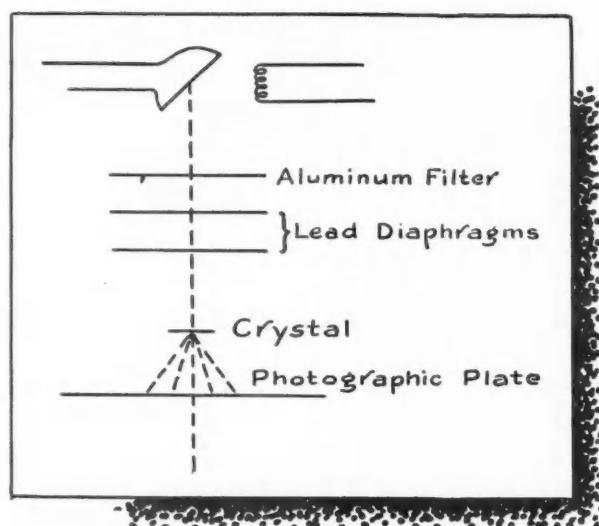


Fig. 3—Diagram of the pin-hole diffraction method.

tals of known interplanar spacings are mounted and rotated; the quantities measured are the angles at which the various components of the beam are reflected by the crystal planes<sup>1</sup>. Upon the photographic film or plotted from ionization readings is the spectrum of the beam. Analysis is complete because the whole process is governed by a simple law

$$n\lambda = 2d \sin \theta$$

where  $\lambda$  is a wave length,  $n$  is the order of the reflection,  $d$  is the known distance between the parallel

<sup>1</sup> Clark, G. L., Applied X-rays Mcraw-Hill Pub. Co., 1940.

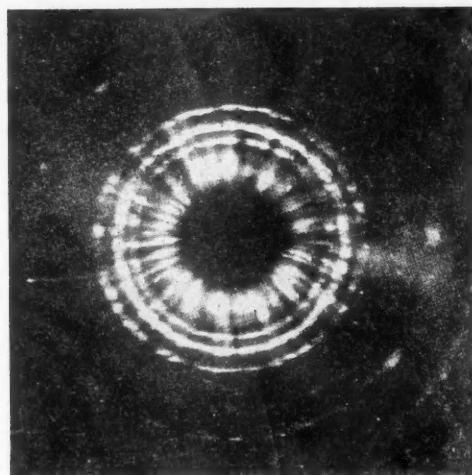


Fig. 4—Pin-hole pattern of stainless steel, showing large, uniform grain.

planes in the crystal, and  $\theta$  is the spectrometrically measured angle of incidence of the ray upon these planes (or  $2\theta$ , the angle of diffraction or reflection.)

A very simple and yet practical method of investigating diffraction makes use of a Seeman spectrograph (Fig. 2). The beam to be analyzed enters the instrument through a slit *s'* and strikes a crystal *c* whose interplanar distance is known. Diffracted beams pass through another slit *s* between two small lead blocks, and are allowed to fall on a photographic film. The entire instrument is kept oscillating throughout the period of exposure, the location of the crystal being used as a pivot, and from the resultant film the wave length of the X-rays used can be accurately determined.

Pin-hole diffraction, as illustrated in Fig. 3, is more widely used and furnishes valuable information relative to the internal structure of various materials. In making diffraction radiographs, a small sample of the material is placed in the path of a narrow pencil of X-rays, in such a manner that the beam is reflected as in the case of a diffraction grating. Exactly the

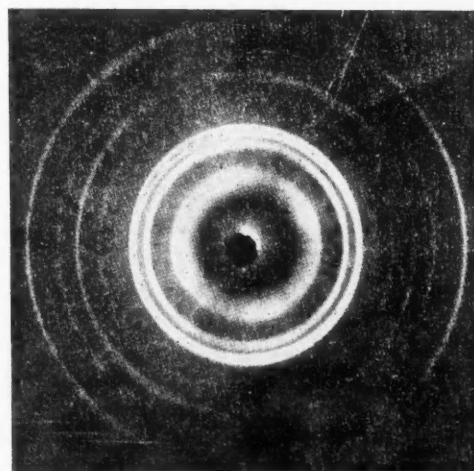
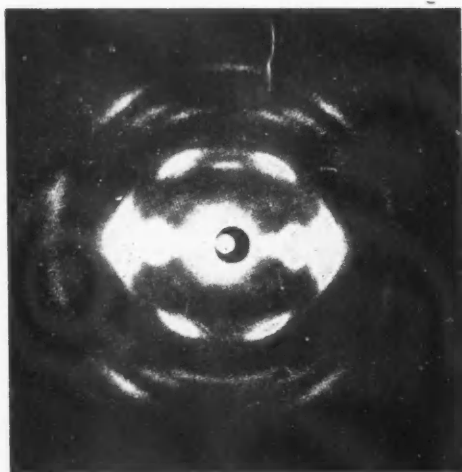
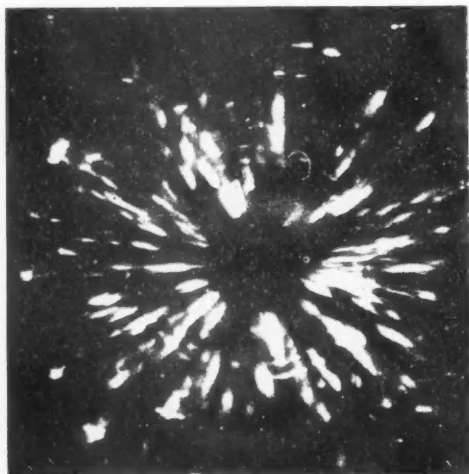


Fig. 5—Pin-hole pattern of stainless steel of fine grain.



**Fig. 6—Pin-hole pattern of stainless steel ingot showing great internal strain.**

same effects are observed as in the case of ordinary light used with a diffraction grating, except that the molecules act as reflectors and the pattern obtained on the film after reflection depends on the molecular arrangement. Each atom within the molecule casts a characteristic line which can be analysed on the film to determine the arrangement of the atoms within the molecule.

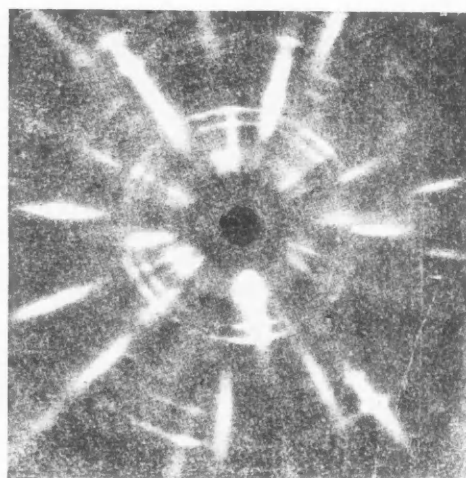


**Fig. 7—Pin-hole pattern of stainless steel showing large distorted grains.**

Diffraction studies are of great importance in the steel and alloy industries, where stresses and strains are vital factors. The method has provided the chemist, physicist and metallurgist with another instrument for use in their quest for improved materials.

Fig. 4 is a pin-hole pattern of stainless steel with large, uniform grains, whereas Fig. 5 is a pin-hole pattern of stainless steel of fine grain, free from strain. Fig. 6 is a pin-hole pattern of a stainless steel ingot with a distinctive crystal structure and great internal strain. Fig. 7 shows a pin-hole pattern of stainless steel having large distorted grains.

Outside of the metals field X-ray diffraction is considered the only absolute means of determining true cellulose, and in Fig. 8 is shown a pin-hole radiograph of Ramie (cellulose) fiber. Diffraction studies can be made to advantage also of adhesives, asbestos, cata-



**Fig. 8—Pin-hole pattern of cellulose fiber.**

lysts, cocoa butter, dairy products, film thicknesses, galvanized coatings, greases, leathers (patent), linseed and Chinawood oils, plastic film, rayon, resin, textiles, medical applications, cellulose, cheese, chicle, coating structures, concrete, electric batteries, fireproofing fibers, glass, ice cream, lime, oleic acid, paper and parchment, precious stones, reflectors, rubber and waxes. To say the least, the new method has opened up avenues for research and improvement far beyond previous horizons.

## Dust a Potent Enemy of Military Vehicles

**W**HEN motorized combat equipment is driven in echelon or column formation during military operations, protection of vital parts against dust becomes a major problem, particularly over desert country where dust concentrations of 0.17 grams per cu ft have been recorded near the ground and 0.035 to 0.055 grams at 6 to 8 ft above the ground. Zero visibility has been established at 0.045 grams per cu ft.

According to L. F. Overholt, International Harvester Co. engineer, a 500 hp tank engine without an air cleaner would take in about 4.9 grams of dust per hp-hr while operating continuously under a 50 per load factor

through a dust concentration of 0.045 grams per cu ft. On the basis of a 10-hour operation the dust to be collected amounts to about 27 lb, which would require a single air cleaner of 24 in. diam or two 15 in. cleaners for a desired 10-hr service interval. Air cleaners over 12 in. diam are awkward to service and are impractical when too large. A 12 in. diam cleaner holds over a gallon of oil and too frequent servicing consumes huge quantities of oil where an Armored Division is involved. Dust protection for the vital parts of the power train, running gear, electrical equipment and controls, like the engine, also offers many difficulties.



# Comparative Aircraft Armament

## Fire Power

THE tables on this page, which were published recently by *The Aeroplane* in an article by Peter G. Masfield analyzing the effectiveness of aircraft armament, present a summary of the performance data for individual guns and for their various

combinations as installed on fighters and bombers in the present war. Data on armament of World War I are included to show the tremendous advances that have been made since then.

In the tables guns and airplanes are listed in ascending order of muzzle horsepower, which the author adopts as the standard to measure fire power for his final rating of them. Muzzle horsepower, which he says is a new criterion for that purpose, incorporates three fundamental properties of a gun—its rate of fire, muzzle velocity, and weight of each projectile—in combination with the kinetic energy of each projectile. The formula derived for muzzle horsepower (M.H.P.) of a gun is given as follows:

$$M. HP = \frac{wv^2r}{1100g} = \frac{wv^2r}{35,420};$$

Where  $w$  = weight of projectile in lb  
 $v$  = muzzle velocity in ft per sec  
 $r$  = rate of fire in rounds per sec  
 $g$  = 32.2

### Fighter Offensive Armament

Airplane	Number of Guns	Total Fire Power (M. HP)	Total Wt. of Fire (Lb/Min)	Total Strikes Per Sec.	Punch (K.E.) of Biggest Projectile (Ft-Lb)
Camel (1918)	2	64	20	13	2,740
S. E. 5a (1918)	2	69	23.7	15	2,740
P-36A (1939)	2	279	92.1	20	13,000
Defiant	4	308	110	73	2,300
S-00 (Zero)	4	480	250	35	14,700
Me 109E	4	491	256.2	35	14,700
Tomahawk (P-40D)	6	537	265	93	13,000
Hurricane I	8	616	220	147	2,300
Spitfire I	8	616	220	147	2,300
Me 110C5	6	726	339.4	88	14,700
Me 109F	3	806	231.2	33	29,700
Hurricane IIB	12	922	330	220	2,300
Typhoon IA	12	922	330	220	2,300
Airacobra (37 mm)	7	1,103	354.5	95	127,000
Lightning P-38	5	1,378	408.9	72	32,200
Airacobra (20 mm)	7	1,406	423.5	114	32,200
Hs 129	5	1,410	430	68,000	
Spitfire IX	6	1,575	445	95	32,200
Me 210A1	4	1,594	431.2	70	29,700
Fw 190A3	6	1,752	606.2	58	29,700
Warhawk (P-40F)	6	1,776	580.2	75	13,000
Corsair	6	1,776	580.2	75	13,000
Wildcat (F4F-5)	6	1,776	580.2	75	13,000
LAGG 3	4	1,776	555	45	26,850
Mustang I	8	1,930	594.8	95	13,000
Me 109G	5	2,238	631.2	59	29,700
Thunderbolt (P-47)	8	2,368	773.6	100	13,000
Whirlwind	4	2,528	650	43	32,200
Hurricane IIC	4	2,528	650	43	32,200
Mustang	4	2,528	650	43	32,200
Typhoon IB	4	2,528	650	43	32,200
Spitfire IX	4	2,528	650	43	32,200
Mosquito	8	2,836	760	116	32,200
Beaufighter	10	2,950	815	153	32,200

### Bomber Defensive Armament

Airplane	Number of Guns	Total Fire Power (M. HP)	Max. Fire Power One Target	Max. Strikes on One Target Per Sec.	Max. Punch Per Biggest Projectile on One Target	Number of Guns One Target
D.H.4 (1918)	3	106	74	18	2,240	2
D.H.9 a (1918)	3	106	74	18	2,240	2
Do 17P (1939)	3	243	81	18	2,450	1
He III H (1939)	3	243	81	18	2,450	1
Blenheim IV	4	308	154	36	2,300	2
Beaufort	6	462	231	54	2,300	3
Wellington II	6	462	231	54	2,300	3
Do 17Z2	6	466	162	36	2,450	2
Boston III	7	539	308	73	2,300	4
Wellington III	8	616	308	92	2,300	5
Stirling	8	616	462	110	2,300	6
Halifax IIA	8	616	462	110	2,300	6
Lancaster I	10	770	616	147	2,300	6
Me 10C5	7	805	726	88	14,700	1
Ju 88A6	5	1,166	716	13	29,700	2
He III H6	6	1,234	910	29	29,700	4
Marauder	5	1,480	784	50	13,000	2
Do 217E2	6	1,668	1,231	29	29,700	4
Me 210A1	7	1,892	1,594	70	29,700	4
Mitchell	7	2,072	1,184	50	13,000	4
Liberator B-24D	11	3,035	2,072	87	13,000	7
Fortress B-17E	13	3,620	2,072	87	13,000	7

### Aircraft Armament Data

Type of Gun	Caliber	Rate of Fire	Rate of Muzzle Energy	Punch (K.E.)	Weight of Fire	Strikes per Sec
	Inches	Mm	Rounds per Min	Muzzle Horsepower	per Projectile (Ft-Lb)	(Lb/Min)
Vickers 303 (1918)	Synchronized	0.303	7.676	400	32	2,740
Lewis 303 (1918)	Free Firing	0.303	7.676	550	37	2,240
German R-M-B M.G.-17	Synchronized	0.3118	7.92	600	45	2,450
Browning .300 cal.	Free Firing	0.303	7.62	1,100	75	2,240
Browning .303 cal.	Free Firing	0.303	7.676	1,100	77	2,300
German R-M-B M.G.-17	Free Firing	0.3118	7.92	1,100	81	2,450
German R-M-B M.G.-131	Free Firing	0.5118	13	900	194	7,200
German Oerlikon	Free Firing	0.787	20	450	201	14,700
German M.K. 101	Free Firing	1.181	30	100	208	68,000
Browning .50 cal.	Synchronized	0.50	12.7	600	237	13,000
Russian Berezin	Synchronized	0.50	12.7	750	278	15,300
Browning .50 cal.	Free Firing	0.50	12.7	750	296	13,000
American A.A. Type F	Free Firing	1.4566	37	85	329	127,000
German Mauser M.G.-151/15	Free Firing	0.6906	15	950	515	17,850
Russian Shvak S.V.	Free Firing	0.7874	20	750	610	26,850
German Mauser M.G.-151/20	Synchronized	0.7874	20	700	630	29,700
British Hispano	Free Firing	0.7874	20	650	632	32,200
German Mauser M.G.-151/20	Free Firing	0.7874	20	800	716	29,700

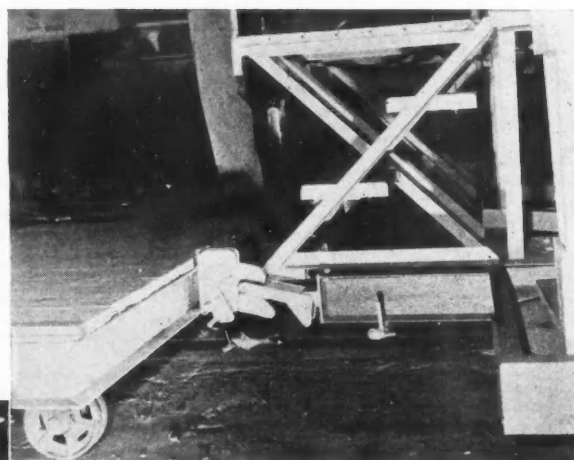


*Lightning coming off mechanized assembly line ready to go to paint hangar for camouflage.*

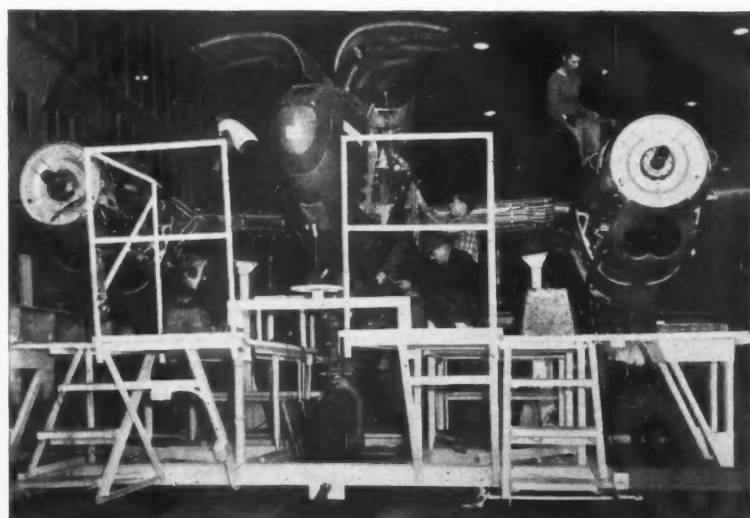
*Lightning fighters start to take form on the line at the right; are shunted over to the middle line where they grow their wings and engines and then move backwards to the far end of the huge final assembly hangar. Then they are shoved over to the third line at the left and for a third time move the length of the hangar, this time to go out the door and into a nearby paint hangar where they are camouflaged.*

**J**UST eight days after Lockheed plant engineers went to work a few weeks ago changing over to a master assembly scheme developed by the Manufacturing Engineering Department, production of Lightning P-38 fighters began on a continuously moving assembly line at an accelerated rate that within 60 days would result in a schedule double the daily output of the old line. The planes are moved down the floor by chain as in an automobile factory, though the complexity of the P-38 with its twin booms, two Allison engines, two superchargers and other intricate equipment piled problem upon problem until the final result as it is seen today has been hailed by all who have seen it as a production miracle. Indeed, so close has Lockheed come to the aircraft industry's goal of building planes on a conveyorized line similar to the automotive industry, that even the vari-

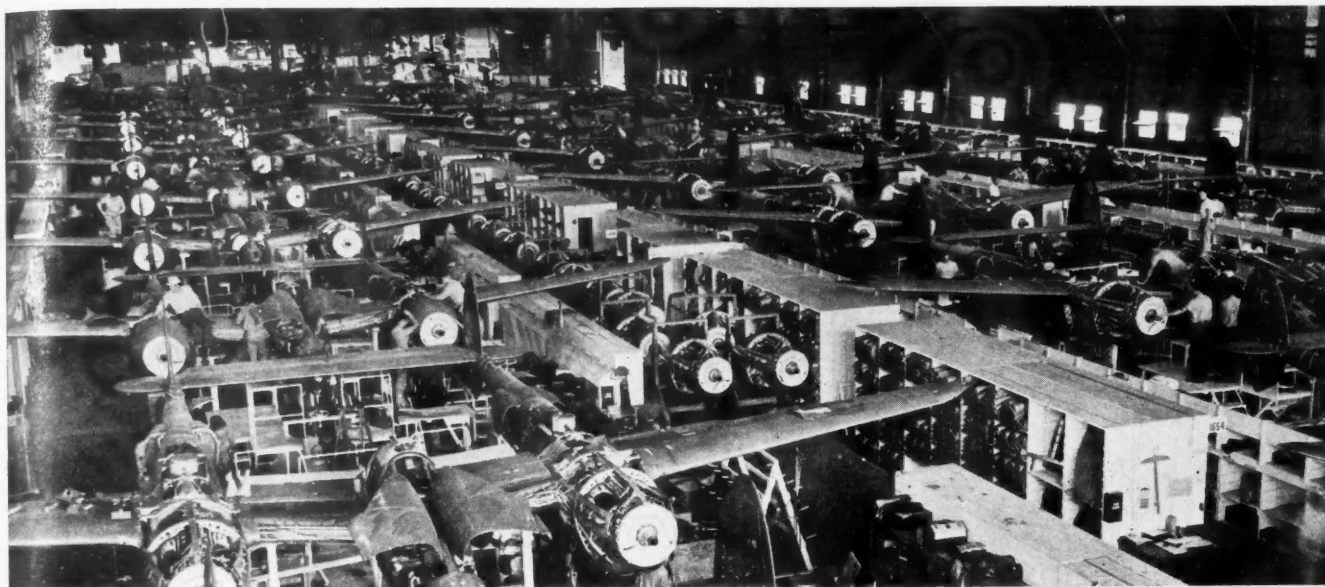
## Mechanized Double



*Coupling by which one movable stand is attached to another to carry P-38 fighters down Lockheed's new continuously moving mechanized conveyor assembly line.*



*P-38's are carried on movable stands hooked together. Power from the moving chain, applied to the lead stand by a coupling attachment, pulls the entire line at a minimum speed of four inches per minute.*



# Assembly Line to Output of P-38 Fighters

*By R. Raymond Kay*



man-hours per plane. No increase in floor space was necessary.

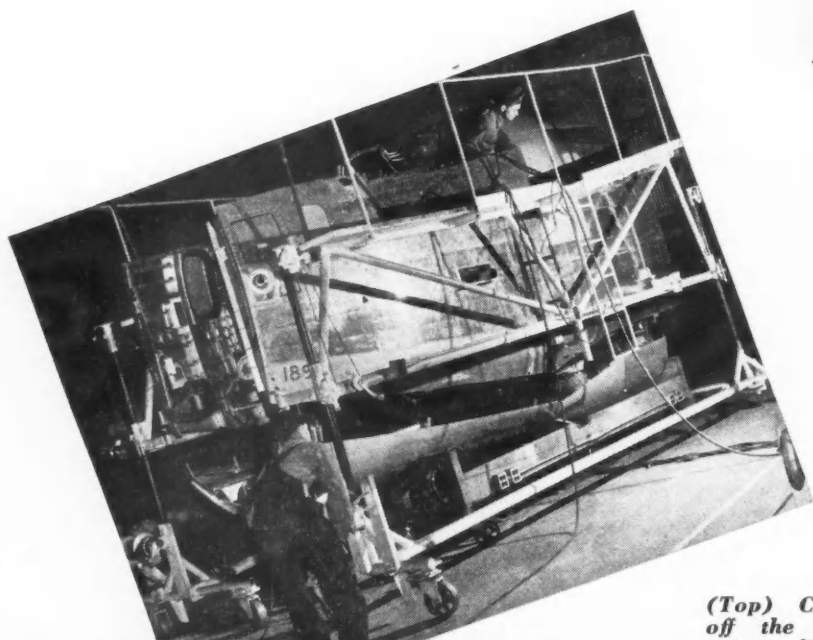
The mechanized lines, of which there are three in the final assembly hangar, now move at a speed of four inches per minute, with a faster tempo to be attained as soon as workmen have become thoroughly familiar with what to them is an entirely new problem—the necessity of getting a given job done before the plane passes to the next work station. The three lines are consecutive as to the order of work to be done, rather than each turning out airplanes independently of the other two. The planes move down one line, shuttle back in the opposite direction on the second, and the third carries them again the length of the building and out the door. Similar continuously moving conveyor  
(Turn to page 82, please)

*Final assembly workers did an impromptu job outdoors during the eight-day period during conversion of the plant to a continuously moving mechanized line.*

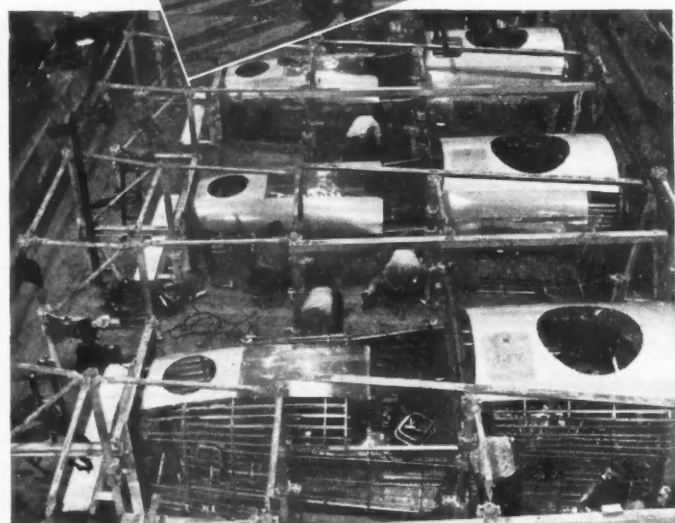


## Separation Method Increases

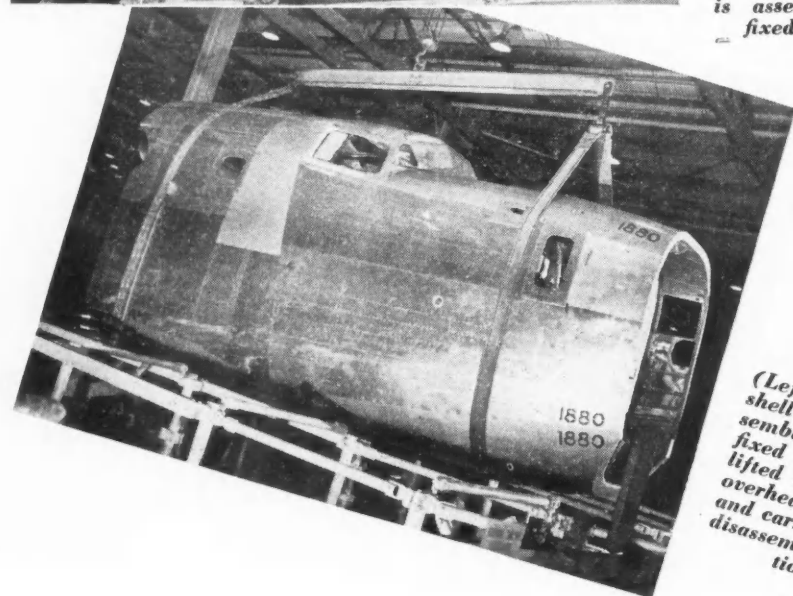
# Liberator



(Top) Coming off the various primary lines, the segments of the nose fuselage section are bottomed together permanently at the re-assembly station. First, the side panels are mated to the internal flight deck and then the bottom panel is joined. Last to be attached are the two parts of the top panel.



(Center left) The shell of the nose fuselage section is assembled in fixed bucks.



(Left) After the shell has been assembled in the fixed bucks it is lifted out by the overhead crane and carried to the disassembly station.

LITERALLY the nerve center of the giant four-engined Liberator B-24 bomber, the nose section of its huge fuselage presented a peculiarly difficult production problem to the San Diego Division engineering staff of the Consolidated Vultee Aircraft Corp. Into the relatively small area of the nose section are crammed all the complicated controls and instruments needed to lift his 28-ton plane off the ground, fly it many hundreds of miles to the objective, drop the six to ten tons of bombs on the target, and bring it home again.

Concentrated in the nose section are approximately 700,000 rivets and parts, and roughly 13,000 feet of wiring, and 2000 feet of tubing. Altogether, about 2000 electrical and plumbing connections are required.

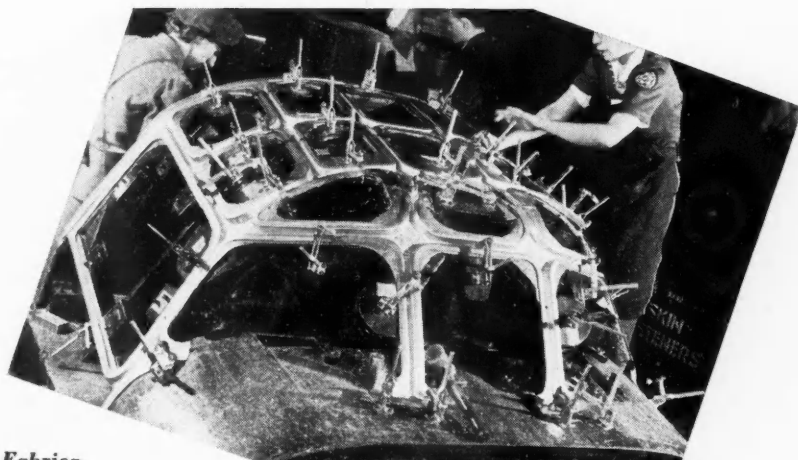
Back in 1940 all the work of frame assembly and instrument installation was done by crews of six, which was the largest number of workers that could get into the limited working space at one time. With 6000 man hours needed to build the



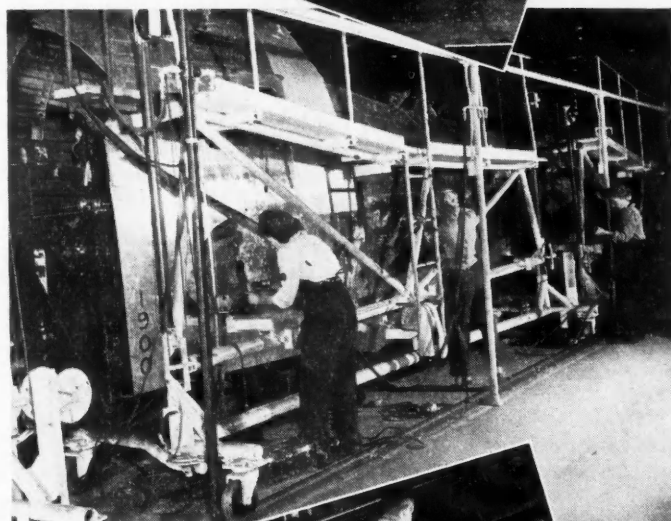
# Nose Section Output

nose section, 50 days had to be allotted for each unit. Obviously, under such a production schedule the greatly increased demand for bombers that came immediately after the war started could not be met. It was apparent that the bottleneck in the construction of the nose section was the small number of workers that could get into the nose at the same time.

The solution was simple in principle and practical in operation. Along major lines of cleavage, the shell of the nose section was broken down into six parts, which are sent down separate primary assembly lines. Here controls, instruments, electric cables, control wires and tubing were installed on each segment simultaneously by hundreds of workers. At the end of the primary assembly lines, the segments are riveted together permanently  
(Turn to page 85, please)

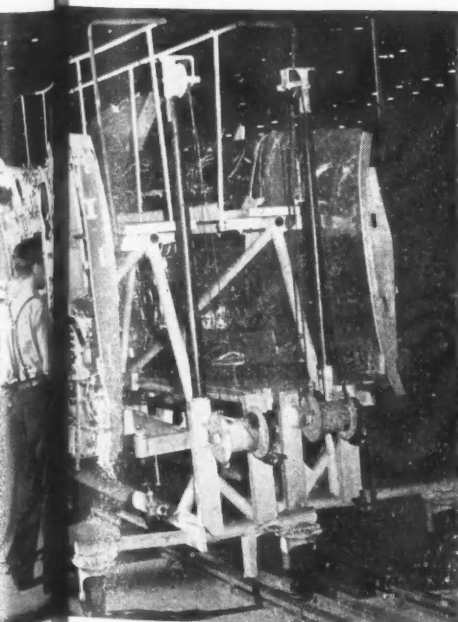


(Top) Fabrication of small basic parts of the nose fuselage section is accomplished on individual jigs.

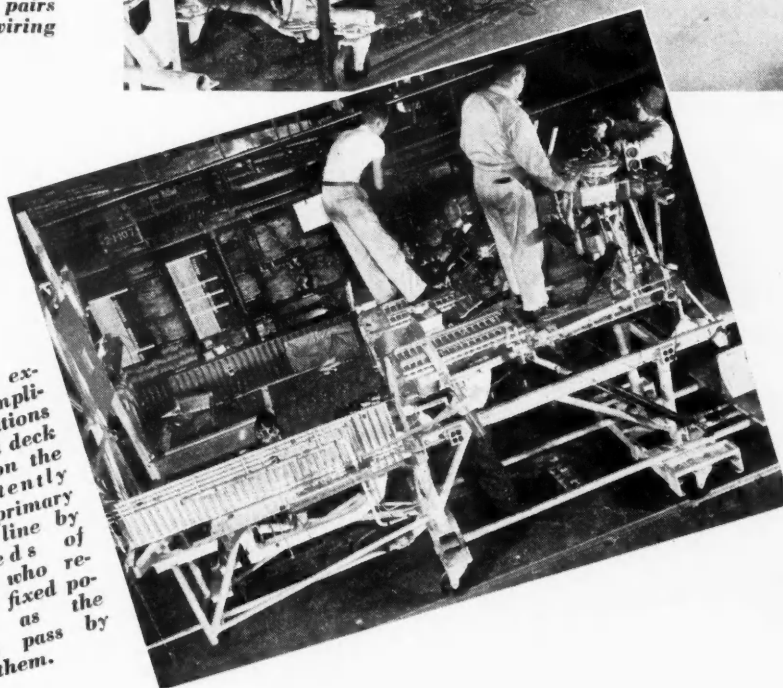


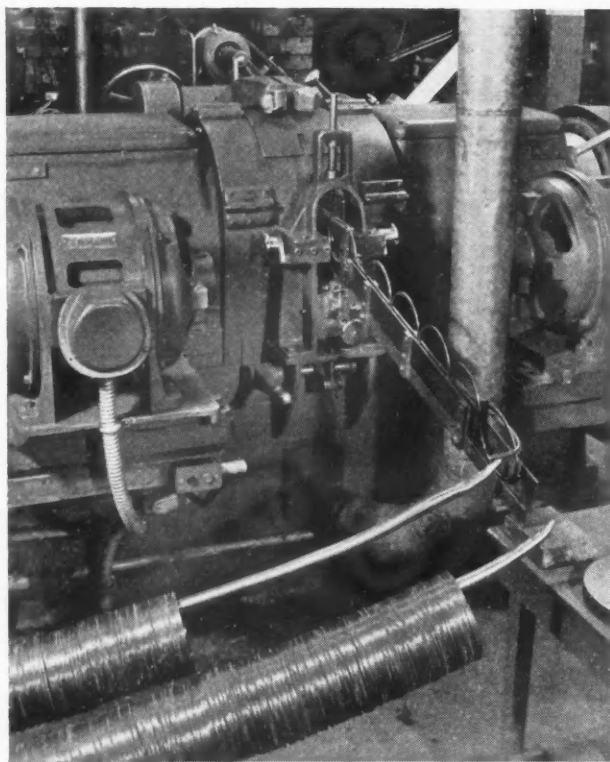
(Center right) On a clean up line those rivets that were hard to reach in the fixed assembly bucks are driven and a few instrument brackets are installed.

(Center below) Faced out, the two side panels go down the primary assembly line in pairs gathering instruments, control systems, wiring systems, and tubing systems.



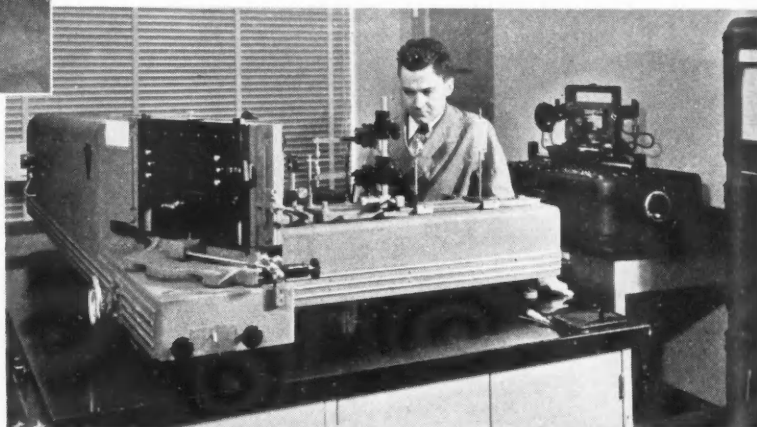
(Right) The extremely complicated installations on the flight deck are made on the intermittently moving primary assembly line by hundreds of workers who remain at fixed positions as the units pass by them.



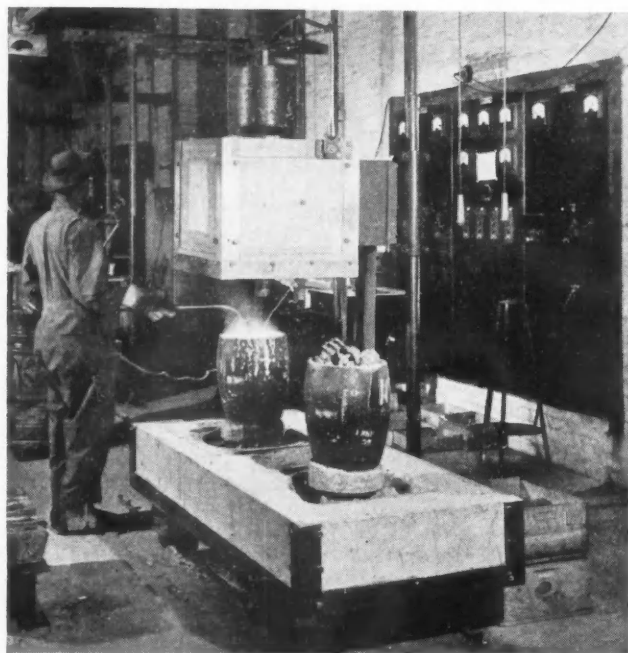


*(Above) One of a group of new Hanchett surface grinders, specially designed for grinding the sides of rings, fitted with magazine feed.*

*(Right) Bausch & Lomb large Littrow spectrograph is prize exhibit in the research lab. This machine speeds the analysis of foundry melts, is used for research as well as for trouble shooting.*



*(Below) View in bronze foundry showing one of the new induction melting furnaces. This equipment has served to increase productivity materially.*



**A**ugmented facilities and nearly thirty years of know how at the American Hammered Piston Ring plant turn out a

## Diversity

**Y**OU can add to your album of inspirational cases on the American system of free enterprise the example of Koppers Company, American Hammered Piston Ring Div., one of the greatest names in piston rings, producers of rings ranging in size from  $\frac{7}{8}$  in. to 120 in. in diameter. Diversity of applications has always been a by-word here. Piston rings for every type of internal combustion engine, for steam engines, for pumps and compressors, sealing rings for soot blowers and special mechanical equipment constitute the daily stint.

Historically, American Hammered has been a piston ring specialist for nearly thirty years, harking back to the beginnings of the automobile era. Starting with modest factory in Newark, N. J., in 1914, its major contribution was made during World War 1 with the emergence of the airplane as a vital factor in warfare. A-H rings were used in airplane engines built by Curtiss, Wright, Packard, and others; on the Hispano-Suiza built by Wright, and on Liberty engines built by Packard. One of the most noteworthy of these engines—the Curtiss OX-5—was practically always fitted with A-H rings.



Portion of large battery of Norton Hyprolap machines which are employed in lapping airplane rings to a surface finish of three micro-inches.

By  
**Joseph  
Geschelin**



## y of Rings for War Machines

During the hectic years of 1916-17-18, A-H was in the forefront with rings for practically every type of self-propelled vehicle, for submarines, sub-chasers, motor ships, and patrol boats.

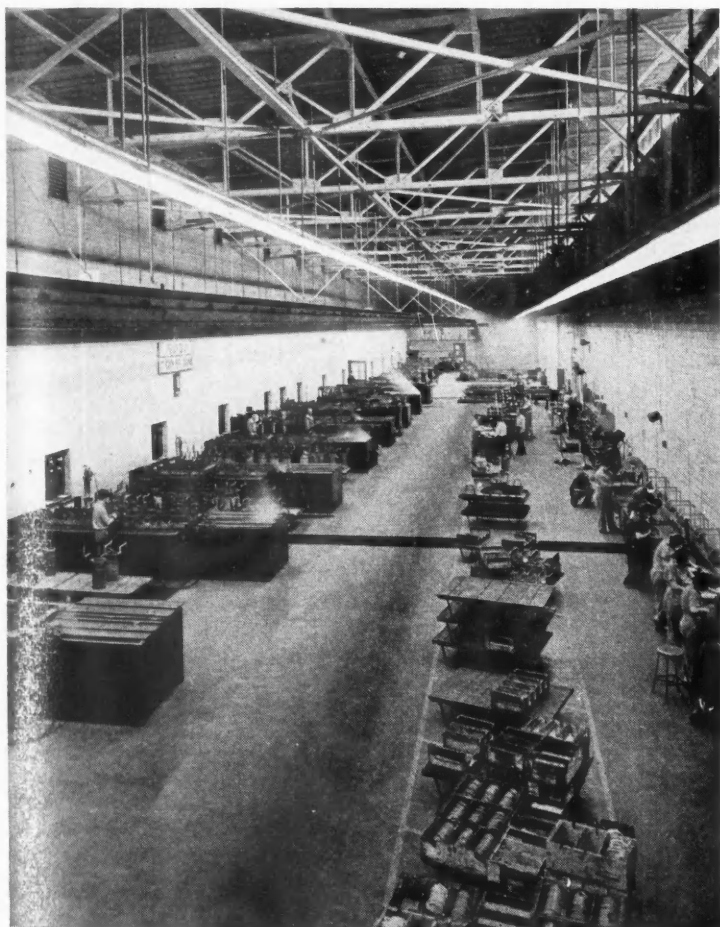
It was indeed a fortunate circumstance that during the period between World War 1 and 2, A-H remained in the forefront in the production and technical development of airplane piston rings. For with the

incidence of the unprecedented military airplane program undertaken by our government, it was possible to draw upon the know-how as well as the productive facilities of this organization.

As pointed out by the writer in *AUTOMOTIVE AND AVIATION INDUSTRIES*, March 1, 1943, early in 1942 the piston ring manufacturers in the U. S. banded together in a cooperative program for the expansion of facilities for airplane engine rings. And in a movement unparalleled in that industry they pooled their technical talents, drawing upon the know-how of A-H for the production-wise background. Thus the specialization of A-H persisting over the years paved the way to an expansion of airplane ring production almost overnight.

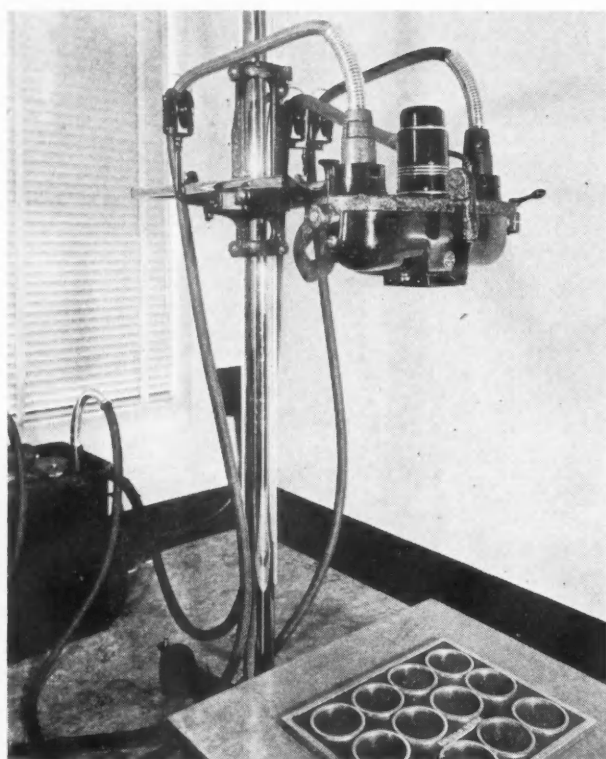
In its diversified operations today, A-H devotes the major effort to airplane rings. However, the current line comprises rings for motorized vehicles, for Victory ships, for industrial equipment of many types, including rings of cast iron, of bronze, and the Gold Seal line of cast iron rings with bronze inserts.

For the most part, A-H provides its own ring castings. To this end the iron foundry was modernized and greatly expanded in 1941, with the installation of modern sand handling equipment, laboratory control, mechanized molding equipment made by Tabor, and mechanized pouring facilities. The iron foundry is divided into two major sections—one for handling large rings over 6-1/16 in. and up to 120 in.; and a highly mechanized section for small rings—6 in. in



*View of new building devoted entirely to the chromium-plating of piston rings, employing the Vander Horst process. This is said to be the largest plating operation of its kind.*

July 15, 1943



*This is the General Electric industrial X-ray machine in the research laboratory.*

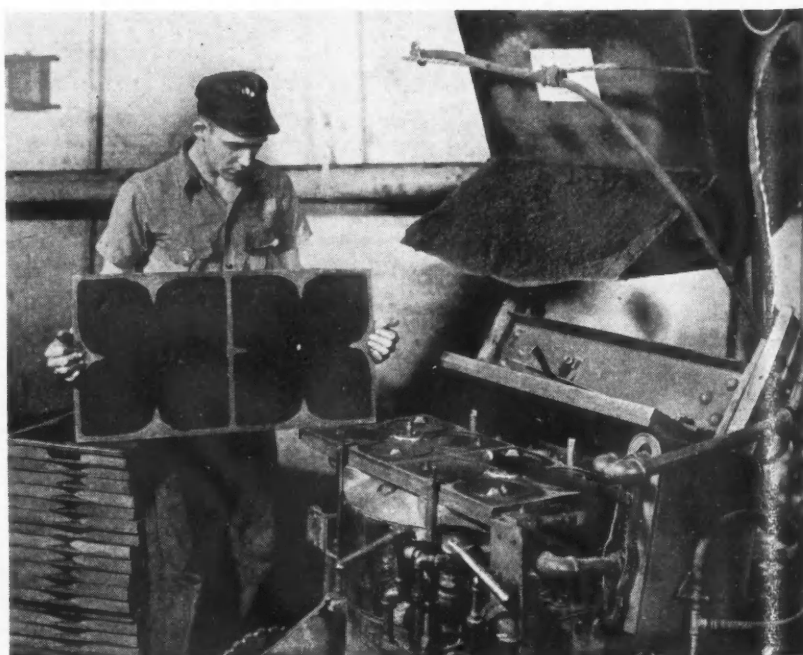
diameter and smaller, including all airplane engine rings.

The bronze foundry, too, has been expanded to take care of increasing war demands. A feature of this operation is the installation of newly developed electric induction melting furnaces, supplementing the oil-fired melting furnaces, thus greatly augmenting tonnage and speeding the melting operation.

For worker comfort, the foundry has been provided with a ventilating system which removes most of the dirt and fumes usually associated with foundry practice.

At this point it may be well to note that research forms the background of all progress at A-H. Engine development in any automotive sphere relies upon advances made in its principal components. To this end there is an unceasing program of piston ring research in the field of metals, foundry control, machinability, physical properties, and the like. Research activities, headed by Dr. Jarrett, are centralized in a new laboratory which constitutes one of the major additions to this plant.

*Character of airplane rings is molded in the foundry. Here is an example of fine machine molding essential to perfection of casting quality.*



The laboratory, departmentalized according to research function, includes—a small machine shop, chemical laboratory, physical testing department, modern pilot heat treating department, X-ray laboratory, spectrographic analysis, microscopic department, specimen preparation.

Physical testing facilities include one of the latest type Tinius Olsen tensile testing machines. X-ray equipment supplied by General Electric is rated 140 KVP. Chief piece of equipment in the spectroscopic lab is a Bausch & Lomb large Littrow machine. It is of interest to note that under war-time conditions the research laboratory, in addition to its functions of fundamental investigation has to pinchhit on problems of trouble-shooting and, on occasion, serves as a pilot operation for new techniques being introduced in the manufacturing departments.

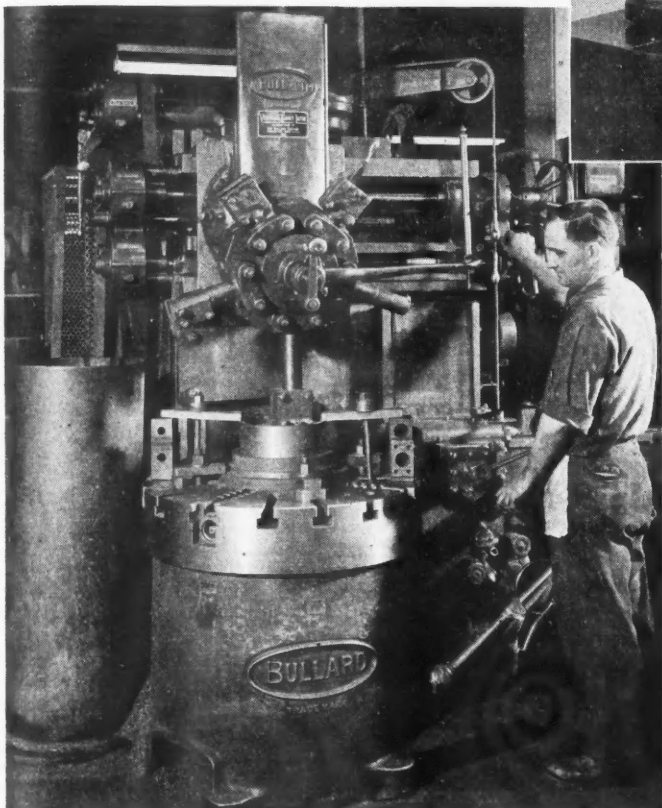
One of the outstanding features of the plant at this writing is the new chromium plating department, said to be the largest operation of its kind. It is devoted exclusively to the chromium plating of airplane engine piston rings, based on the VanderHorst system of porous hard chromium plating. The present installation—equipment, control, etc.—is based upon a license agreement with VanderHorst, stems from a relationship established from the time that VanderHorst left his home in Holland.

A modern touch by way of plant protection against fire hazard is the adoption of the Cardox CO<sub>2</sub> system, so widely employed in most of the major airplane engine plants. At A-H the Cardox system features the use of the Cardox Transitruck units which are located at strategic points throughout the plant.

When it comes to the actual manufacturing procedures involved in the making of piston rings, it is necessary to speak in generalizations since ring production is an exceedingly intricate affair, still further complicated by the many types and sizes, each of which varies from another in some detail. Moreover, the piston ring is by no means as simple an element as it

(Right) Tinius-Olsen tensile testing machine forms part of the mechanical equipment in the new research laboratory.

(Below) This Bullard V-T-L is an example of the equipment used for machining the large rings. Here is shown the boring of large rings, using cemented-carbide cutting tools.



this implies a departure from the tradition that all piston ring equipment is so special that it must be designed and built by the user. This change in thinking rests upon a background of many years of experience and a thorough search for methods and techniques and tooling designed to adapt conventional equipment to this specialized type of manufacture.

Looking at the plant as a whole, it may be said to consist of a number of self-contained departments. One plant, greatly crowded with extra personnel and equipment, handles primarily the machining of the large and special rings. Here will be found the big Bullard V-T-L's, and large Cincinnati milling machines; the former for turning, facing, and boring large rings, the

appears. Its development begins with the melting of metal and the controls imposed upon foundry practice. As it progresses through the variety of metal cutting operations, the ring assumes qualities of size and finish and physical properties which must match the requirements of the engine for which it has been specifically developed. A good piston ring is more than just a thin circle of cast iron.

One thing that stands out in this plant is the utilization of production machinery closely akin in make and type to the equipment found in modern automotive plants through the automotive industry. Significantly,

*Here is a close-up of one of several lines of familiar Cincinnati milling machines used for milling the ring gap. The table is provided with an indexing fixture which permits the operator to load at the outside station while the front station is being milled.*







*A large number of Sundstrand automatic lathes attest the modernity of the machine shop set-up. This equipment is used for turning the O. D., using cemented-carbide tools.*

latter for cutting slots and grooves. In a corner of this plant is what is called the "S-O-S" department. This is a small, self-contained operation for handling short orders and special rings, thus screening such work from the main manufacturing department, eliminating the usual bottlenecks in production due to special setups and small lots.

Another building accounts for the bulk of airplane ring production, although some operations for this department are handled in the first plant referred to above. Here will be found the most impressive group of Norton Hyprolap machines to be seen under one roof. In all A-H boasts about 90 of these machines at the present time. These Hyprolaps are responsible for the six micro-inch finish for which the A-H airplane rings are noted.

Equipment of similar type is grouped in long rows throughout the plant. One department contains a great battery of special boring machines for finishing the inside diameter of rings while held in special pot-chucks. Another department boasts long lines of Sundstrand automatic lathes for turning the OD, rings being mounted on long or short mandrels, depending upon their size.

Then there is a large battery of the familiar Cincinnati milling machines—small, horn-type equipment. These are used for milling plain gap rings. To speed this operation, the table is fitted with a two-station rotary fixture with a mandrel extending from each side of the vertical post. While one side is in cutting

*Part of battery of Parnesdril vertical machines adapted for the lapping of the O.D. of certain types of airplane engine rings. Rings are mounted on the ram or spindle, rotated and reciprocated within a special cast iron sleeve.*

position, the operator loads the other side, keeping the cycle going without interruption.

Wedge-faced rings are finished on rotary surface grinders with inclined heads to give proper angularity. Scallops in oil control rings are ground individually on rapidly-indexing grinders.

Specially designed Hanchett surface grinders are employed for the rough and finish-grinding of sides of rings.

Some of the rings are specified with a lapped finish on the OD. This operation is performed on a battery of Barnes Drill machines, of the type and size familiar in automotive plants. For this operation the rings are stacked on a special mandrel which is attached to the reciprocating ram and finished by operating in a cylindrical lap, simulating the cylinder within which the rings will normally run.

Cemented-carbide tools of various makes—Carboloy, Firthite, Vascoloy-Ramet—are invariably used for the metal cutting operations. C-t-c tipped tooling permits exceptionally high speed and produces an excellent finish on such operations as boring, turning, on the small machines as well as on the Bullards and boring mills.

Based upon many years of shop experience, A-H quality control encompasses not only the usual final inspection but individual shop inspection as well. That is to say, there is formal inspection, either visual or dimensional, following each major step in the machine shop. The effect of this is to screen defects at the source without permitting the work to enter another operation unless it is absolutely right. Under present-day conditions of production pressure, in particular, this procedure eliminates waste time, reduces the expense of rejects.

Because of this procedure, inspection benches will  
(Turn to page 90, please)

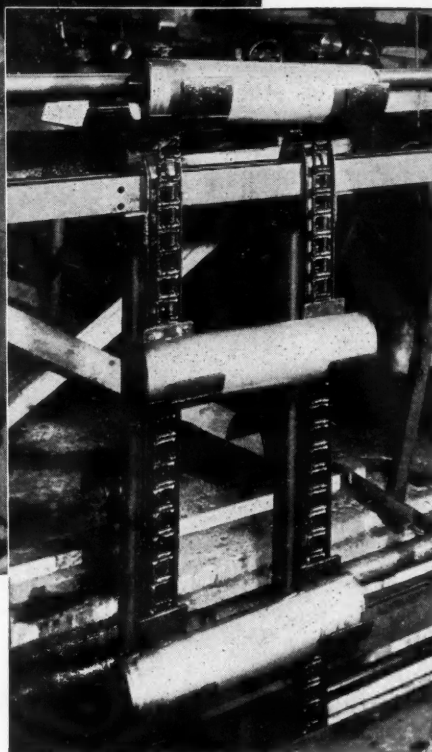


INLAND SHEETS  
AT WORK FOR  
VICTORY



*Here 7-in. cylinders are turned inside out and reduced to 6 in. diameter.*

## 4½" x 17" Steel Cylinders— Drawn from Inland Sheets



*Cylinders, drawn to 4½-in. diameter by 17 in. deep through a ring die, are conveyed from the press pit to the finishing floor.*

Only four operations are necessary to form a 4½-in. diameter by 17 in. deep cylinder that is part of a shell container used by the U. S. Navy.

In the first operation an 18-in., 19-gage, blank, cut from Inland deep drawing sheets, is formed into a cylinder 10 in. in diameter by 6 in. deep. The second operation reduces the diameter to 7 in. and increases the depth to 8⅞ in. In the third operation a 7-in. by 8⅞-in. cylinder is placed bottom end up over the lower die. The upper die, pressing against

the bottom of the 7-in. cylinder, forces it into the lower die, turning the cylinder inside out while reducing the diameter to 6 in. and increasing the length to 12⅝ in. In the final operation a 6-in. cylinder is placed over the upper die which forces it through a ring die, drawing the cylinder to final size, 4½ in. in diameter by 17 in. deep.

These cylinder forming operations, like many other difficult war jobs, are proof of the uniformity and high quality of Inland flat rolled steel products—products that are being used 100% for Victory.



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# Airbriefs

By Henry Lowe Brownback

## Fighters

Our own P-38 is making history in many ways. Starting as a high altitude interceptor fighter it has become the "Jack of all Trades" of the Army Air Forces. They have been fitted with extra tanks for long range fast flights and convoy duty, with some special stunts which make them into formidable dive bombers and latterly with bomb racks carrying fairly large bombs to make the fastest short range bomber in the world. An officer friend of mine told me of an incident in Africa. An Italian aviation officer, who had been captured, was being questioned and suddenly burst out in a fury:

"The war had been going well, the Axis had been winning until the Americans came with their forked tail planes and spoiled the whole show. It wasn't fair. Why couldn't they have stayed home and let Europe settle her own wars."

He then went on to tell some of the things the P-38's had done to spoil the show.

## Magnesium

Aluminum has done much to change pre-aluminum mechanical ideas and it now seems that magnesium is to enter into a period of development where it will be to aluminum what the latter was to cast iron about the turn of the century. Heretofore, magnesium was tricky and expensive, but modern alloying and heat treating techniques have eliminated the first of these objections while the new system of extracting it from limestone has made it more readily available than aluminum in many places. As Elektron the Germans have used and marketed magnesium for years and today it is one of their major aircraft fabricating materials.

## Pilots

There is the question of pilots and what influence they are going to exert on plane design after the war. I believe that the design of the sport plane of the twenties and thirties would have been a lot different had there been no World War pilots and I am just as certain that the fact that most of the flyers being trained today are

learning to fly not docile pleasure or commercial craft, but veritable thunderbolts, is going to have a bad effect on post-war small plane aviation as far as the production of "everyman's plane" goes. You can't take a young man and teach him to do stunts on the race track with a Lagonda, Bentley or Bugatti owned by someone else and then expect him to get any great kick out of buying a 5 HP FIAT for himself and change gears every time he isn't going down hill!

Most civilian buyers will want something that is safe and easy to fly and your young ex-military pilot will want something he can "turn inside out" and this will complicate the problem of the really cheap mass production plane. It seems to be human nature to start out being contented with something modest and then demanding that it be increased in size, luxury and power even at the cost of economy. Here we have had the Plymouth, the Chevrolet and Ford starting out as small cars and turning into really large luxury cars and this is just as true in Europe where the small cars like the Citroen and Peugeot became really good-sized vehicles even in the face of high operating costs and low incomes.

Small vehicles come in waves as the small car or plane gradually grows in size to the point where it cannot fill a large market demanding something small and economical and at this time a whole new crop of small vehicles appears upon the scene. What the post-war plane and car will be depends largely upon the economic condition of the younger generation after the war is over on the one hand and what the maximum amount of power, speed and comfort it can get for what it has to spend on the other.

## Powered Gliders

Most people have no idea of the giant size of some of the large power gliders used by the Germans to carry over 150 men and fitted with six or seven engines. Some of these machines are really relatively slow transport planes with low unit wing loadings, while others are said to be really powered-gliders which are towed on the take-off and have just enough power to maintain altitude once they are towed to it. It is no secret that the Germans are not the only people making experiments along these lines.

## Wood Finishes

I have seen some wooden aircraft parts having finishes one would have declared impossible. Some of these are applied directly to the wood and are heat dried while another is obtained by coating the sealed wood with dope, applying pre-doped fabric to this and bonding the whole works with a special dope sprayed on hot and then finished with metallized dope.

## Designs

Our Government deplores the fact that there seems to be a lack of appreciation on the part of a large section of the public of the seriousness of this war. In answer the public might sit the baby right on the knee of the authorities who show the public little but posed pictures of victory and how nice the war is. The British are doing a better job, particularly in showing the public details of the machines of war and about all that our own people get to see are reprints from British papers. AUTOMOTIVE and AVIATION INDUSTRIES has been particularly generous to its readers with articles on war equipment and everyone should study them carefully.

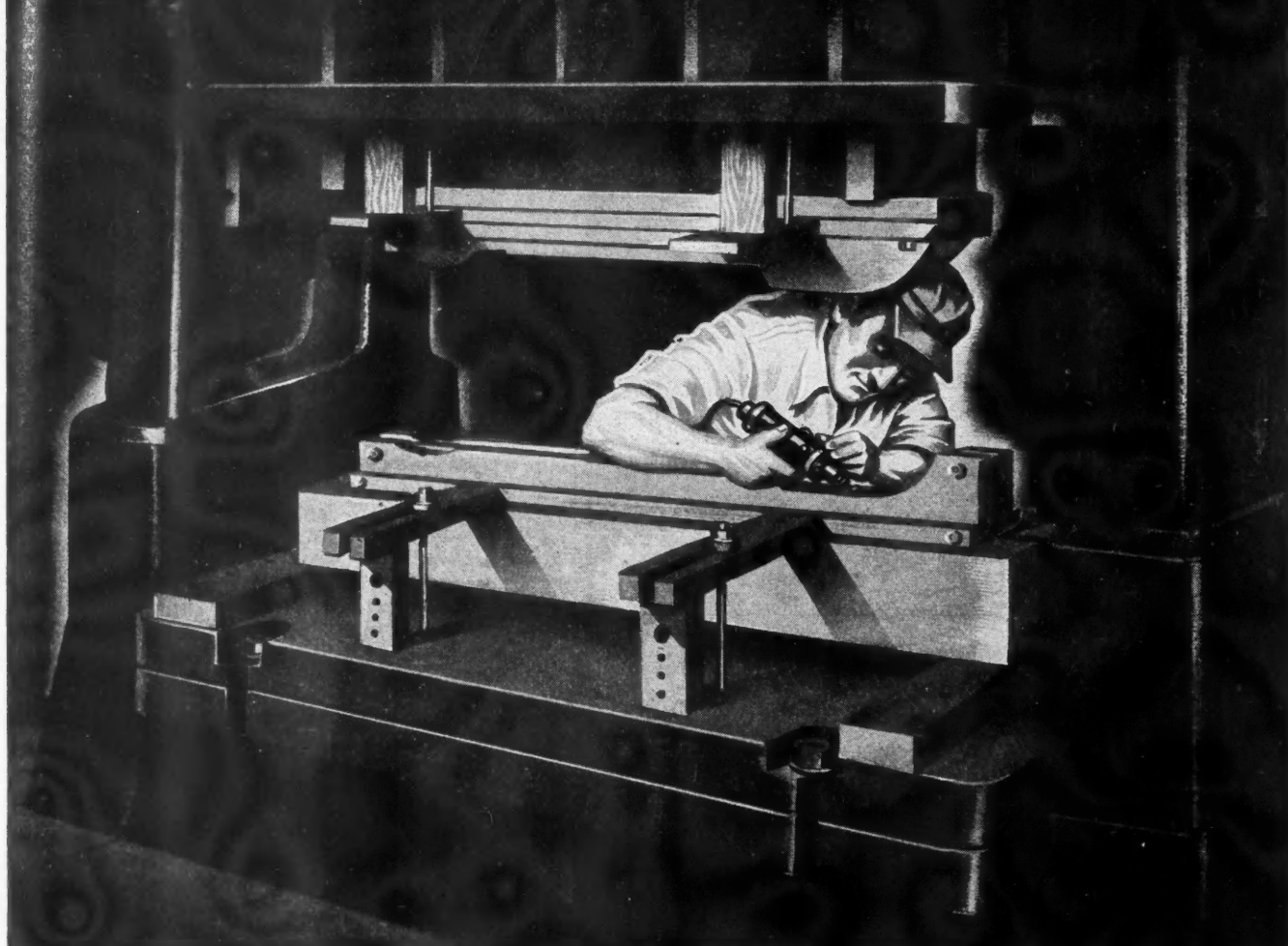
One showing the deHavilland Mosquito was particularly interesting to anyone who has worked with wooden aircraft. I have had assemblies of nearly all of our wooden aircraft pass over my desk and they all show signs of being wooden conversions of our excellent metal planes rather than designs made to take advantage of the good properties of wood and to avoid as much as possible its weaknesses. The Mosquito is a real wooden airplane design born of a long distance racer and refined for war. The entire layout is based upon a sound wooden structure and not a messy mixup of wooden parts and metal fittings with bolts trying to shear their way through wooden blocks. Metal is metal and wood is wood and each must be handled in a different manner.

One may say that the Europeans have experience with wood while we have the metal experience. Maybe this is so and if it is why don't we build the Mosquito or some other foreign design as a bomber or advanced trainer instead of messing about getting nowhere. The fact that exposing some of the failures to build wooden planes in the face of existing metal shortages would be in violation of military secrecy rules prevents me from mentioning a few of the bad breaks which we have made.

With communication as rapid as it is and the cause as urgent as it is, there is no excuse for the British to build something poorly that we build well or vice versa.



## Determination of blanking die clearances



### *Information supplied by an Industrial Publication*

Determination of proper blanking die clearance depends on several factors; thickness and physical properties of stock, relation of punch diameter to stock thickness, specified part tolerances and press power and size.

Recommendations of material suppliers regarding clearances for every type of blanking operation can usually be followed. Lacking recommendations, or when clearance must be determined by experiment certain simple rules give reasonably accurate results.

The amount of clearance varies from 5 to 12% in direct proportion to the stock thickness. Closer

tolerances call for smaller clearances. The following table gives general average total clearances.

	Close Tolerance	General Run
Brass and Soft Steel	5%	8%
Medium Rolled Steel	6%	10%
Hard Rolled Steel	5-7%	12%

When the blanking or piercing hole must be held to a close tolerance, clearance is added to the punch dimensions. When the blanked part must be held to close tolerance, clearance is subtracted from the dimensions.

CLIMAX FURNISHES AUTHORITATIVE ENGINEERING  
DATA ON MOLYBDENUM APPLICATIONS.



MOLYBDIC OXIDE, BRIQUETTED OR CANNED •  
FERROMOLYBDENUM • "CALCIUM MOLYBDATE"

**Climax Molybdenum Company**  
**500 Fifth Avenue • New York City**

## AUTOMOTIVE *and* AVIATION INDUSTRIES

# No Thread Seizure!

## LONG STANDING, LEAK-PROOF UNIONS DISASSEMBLE READILY!

The lubricating, non-hardening properties of Permatex Pipe Joint Cement permit easy readjustment of pipe lines . . . without thread seizure.

Permatex Pipe Joint Cement is a heavy, brushable, ready-to-use product. It flows easily from the brush, spreads evenly over the threads and "stays put".

The applied film is leak-proof to hot and cold water, steam, salt water, illuminating gas, lubricating oils, gasoline, gasoline vapor, kerosene, ethylene glycol and numerous other liquids and gases.

Permatex Pipe Joint Cement is used wherever pressure-tight, leak-proof unions are required.



PERMATEX COMPANY, INC.  
Sheepshead Bay, N. Y., U. S. A.

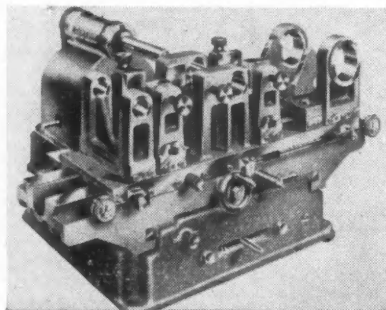


# New Production Equipment

**A** NEW Connecting rod boring machine has been introduced by Century Engineering Company, Los Angeles, Cal.

The new Century equipment is small enough to be taken into the field and requires only a 110 volt connection and one air hose to be ready for operation. The base casting is rigid and suspended on three feet to prevent distortion, so the machine need not be leveled.

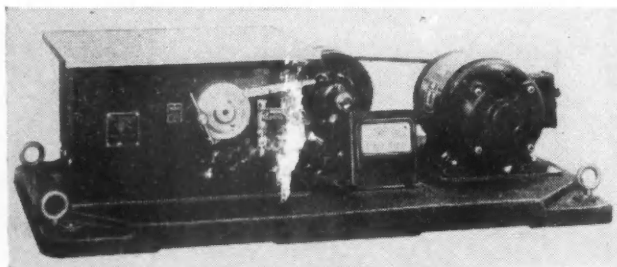
The part to be bored is fed into the boring bar with a hydro-pneumatic feed of Century's design. To bore a rod, space bars for the specific rod are used to set the rod centers. The rod is then placed in position on two mandrels and held until the self-centering and self-equalizing clamps are tight-



*Century connecting rod boring machine*

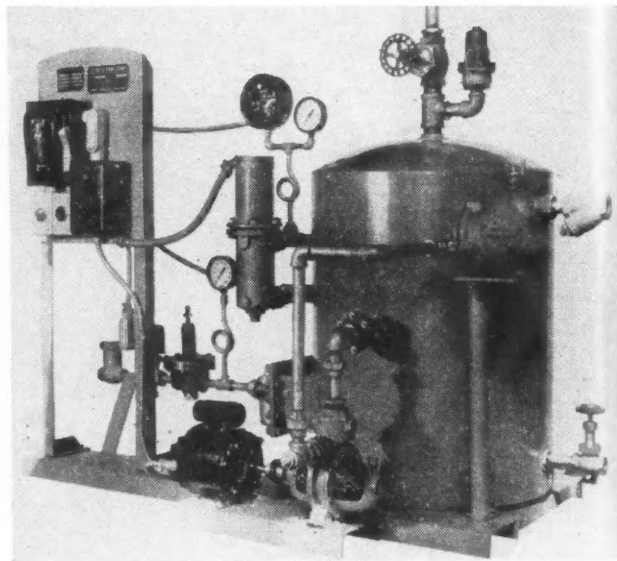
ened. These clamps prevent any stress on the rod. The mandrels are then removed and the first hole is bored. Without moving the part, the entire fixture is moved to the second position by means of a handwheel which operates the cross slide, and checked with the dial indicator. The second hole is then bored.

As the rod is never released until both ends are bored, the holes are parallel, without the possibility of any misalignment due to an extra set-up.



*Model 100 vibration fatigue testing machine.*

*Model 35-S Dee Tee Vapor Cleaner*



**C**IRCO Products Company, Cleveland, Ohio, has just brought out a vapor degreaser for cleaning and thawing differential, transmission and transfer cases of motor vehicles. This Model 35-S Dee Tee Vapor Cleaner permits servicing as many as five housings at one time, and the complete job can be done in 7 to 10 minutes.

The degreaser uses Dee-Solv Solvent, which, when heated, creates a constant flow of hot vapor into the housings where the vapor penetrates through the lubricant and condenses on the colder metal. As the temperature of the vapor is between 250 and 275 deg. F., all water is completely removed and the parts are left clean and dry.

**T**HE MODEL 100 is the latest addition to the line of vibration fatigue testing machines being made by the All American Tool & Mfg. Co.,

Chicago, Ill. The new unit will handle parts or assemblies up to 100 lb., which are to undergo vibration fatigue tests. The table has an area of 15 in. by 18 in. and has 115 tapped holes for bolting on objects. Table movement is horizontal.

The frequency is adjustable while machine is running, from 600 to 3,600 vibrations per minute and is recorded on an electric tachometer. Displacement is adjustable from 0 to .125 in. The maximum capacity is 23g.

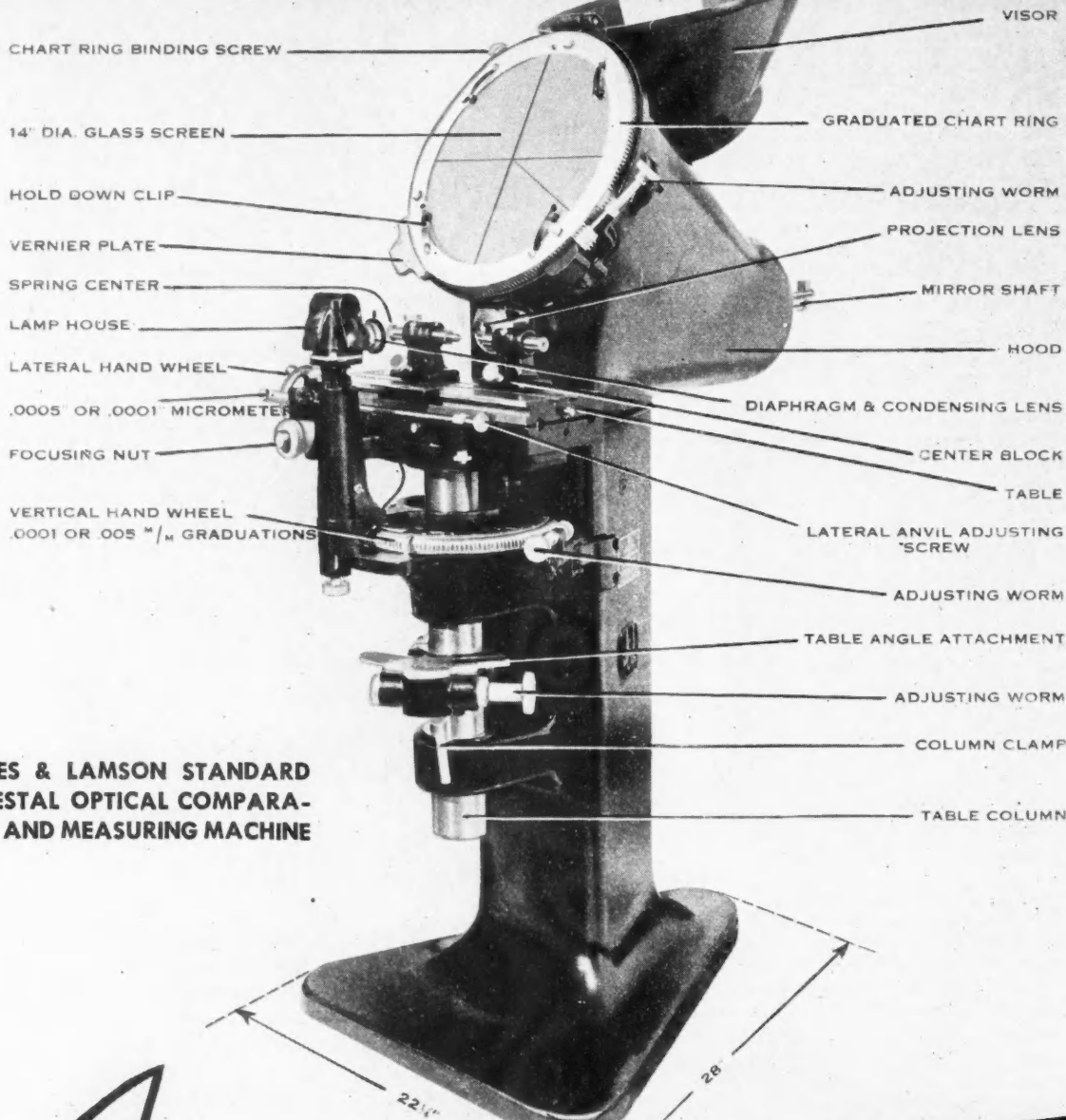
Base area of the unit is 24 in. by 42 in. Weight is 550 lbs. A 1½ h. p. motor supplies power. Eye-bolts in the base permitting handling with a shop hoist or crane.

**W**ITH its GF-41 Bit Grinder, the Onsrud Machine Works, Inc., Chicago, Ill., makes available a machine for resharpening spiral router bits speedily and accurately. Bits sharpened on this grinder are said to be restored to the condition in which they left the factory.

The GF-41 is powered by a three stage impulse reaction type air turbine motor, the Onsrud E-6, developing 3½ H.P. at 30,000 RPM. Entire motor assembly swivels for correct adjustment to any grinding angle. Vertical lift as well as in and out adjustment of motor unit is controlled through hand screws.

*(Turn to page 103, please)*

**JONES & LAMSON STANDARD  
PEDESTAL OPTICAL COMPARA-  
TOR AND MEASURING MACHINE**



# A Complete Inspection System FOR TOOLROOM OR SHOP

Thousands of Jones & Lamson Optical Comparators are in use today for the inspection and measurement of a great variety of parts where, often, other methods had failed or had been too costly. Their use has resulted in better tools and gages, greater efficiency in inspection and substantial saving through the elimination of costly mechanical gages.

Our Comparators cover the whole field of Inspection by Optical Projection and our inspection engineers will welcome the opportunity to study your inspection problems and make recommendations based upon more than twenty years experience in this field.

**JONES & LAMSON**

**MACHINE COMPANY**  
SPRINGFIELD, VERMONT  
Manufacturers of: Universal Turret Lathes  
Automatic Lathes • Automatic Thread Grinders  
Optical Comparators • Automatic Opening  
Threading Dies.



**PROFIT-PRODUCING  
MACHINE TOOLS**

## War Production of Automotive Industry Was \$685,000,000 in May

*Output of Military Vehicles and Parts Was Lower in First 3 Months of 1943 Than in First Quarter of 1942*

War production by the automotive industry in May totaled \$685,000,000, which is at an annual rate of \$8,220,000,000, according to the Automotive Council for War Production. Total output by the industry was \$5,486,000,000 in 1942 and approximately \$5,000,000,000 in 1941 but in the latter year more than 80 per cent was civilian automobiles and trucks. The changing character of the automotive industry's war production is illustrated by a comparison of the first quarter of 1942 with the first quarter of 1943. In the first three months of 1943 aircraft and parts comprised 33.2 per cent of the industry's war output contrasted with 22.8 per cent in the same period of 1942. Tanks and parts climbed from 6.8 per cent to 17.8 per cent in the first quarter of 1943.

Military vehicles and parts, which comprised 49.7 per cent of production in 1942's first quarter, declined to 25.1 per cent. Guns held steady at 9.5 and 9.6 per cent, respectively, while ammunition was 3.8 per cent of total output in both periods. Marine equipment advanced from 4.9 per cent to 8 per cent in the first quarter of 1943.

Twenty-five automotive companies are building military vehicles, 10 are producing armored cars and nine are making tanks. The major producer of light tanks, Cadillac Motor Car Division of GM, is going out of tank production at the Southgate, Cal., plant, concentrating the light tank manufacture in Detroit. The Southgate plant used as Pacific Coast assembly plant for Buick, Oldsmobile and Pontiac before the war, has been leased to Douglas Aircraft Co., Inc.

Effective Sept. 1, the M-5 tank is powdered by Cadillac engines which also are used in the Australian medium tank. At Detroit, Cadillac was able to convert 70 per cent of its automotive machinery to tank production. The assembly line is broken into six major stations, each of which serves as an inspection point beyond which a tank cannot go before meeting the necessary standards. Turrets and gun mounts are first built on stands and tested for accuracy and mobility before installation in the tank.

Caterpillar Military Engine Co., a subsidiary of Caterpillar Tractor Co.,

soon will go into production on a heavy duty radial Diesel engine at a new DPC plant in Illinois. No radial Diesel engines at present are being installed in U. S. tanks now in production but the Special Engine Committee of the Ordnance Dept., in drawing up the requirements for an ideal tank engine, stated it should be 650 gross hp, horizontal or V-type, air-cooled, 1,000-hour life between major overhauls and equipped with an injection system capable of handling Diesel fuel, gasoline or other available fuels. International Harvester Co., which had an \$80,000,000 tank contract cancelled in April, plans to produce new high-speed mili-

tary tractors in the facilities at Davenport, Ia., that had been prepared for tank manufacture.

General Motors Truck & Coach Division of Yellow Truck & Coach Mfg. Co. is the largest producer of 2½-ton 6x6 military trucks for the Army. These all-purpose vehicles perform many duties, including use as prime movers for 75-mm. and 105-mm. guns, carrying complete radio sending and receiving equipment for the Signal Corps, as mobile repair shops for ordnance maintenance units and to transport water purification plants. Substitution of wood for steel in these truck bodies has saved 1,000,000 pounds of steel for every 1,000 trucks.

Most unusual version of the 6x6 is the "duck," an amphibian truck that can traverse either land or water. A water-tight steel hull encases the truck frame assembly, below which are the springs, spring brackets and wheels. In the water the vehicle is driven by a rear-mounted propeller. The steer-

*(Turn to page 72, please)*

## Many Copper Producers Favor Compulsory Stockpiling Bill

*Consumers Fear That the Scrugham Bill Would Not Prevent a Price Rise in the Post-War Metal Market*

By W. C. Hirsch

Unavoidable as the metal market has right along considered the problem of how Government holdings of strategic metals, such as copper, tin, tungsten, chromium, etc. should be disposed of at the end of the war, so as to insure as speedy a return to normalcy as possible, introduction at this early date by Senator James G. Scrugham of Nevada of a compulsory stockpiling bill has brought out animated discussion of the subject. The United States Copper Association, the membership of which is credited with more than 90 per cent of the primary domestic output of copper, and other organizations of mine producers of the metals affected have lined up behind the Scrugham proposal. "All available surplus stocks, whether in the form of ores, concentrates, process materials, scrap or other form should be currently processed, refined and stored as a war reserve," says a statement submitted by the Copper Association.

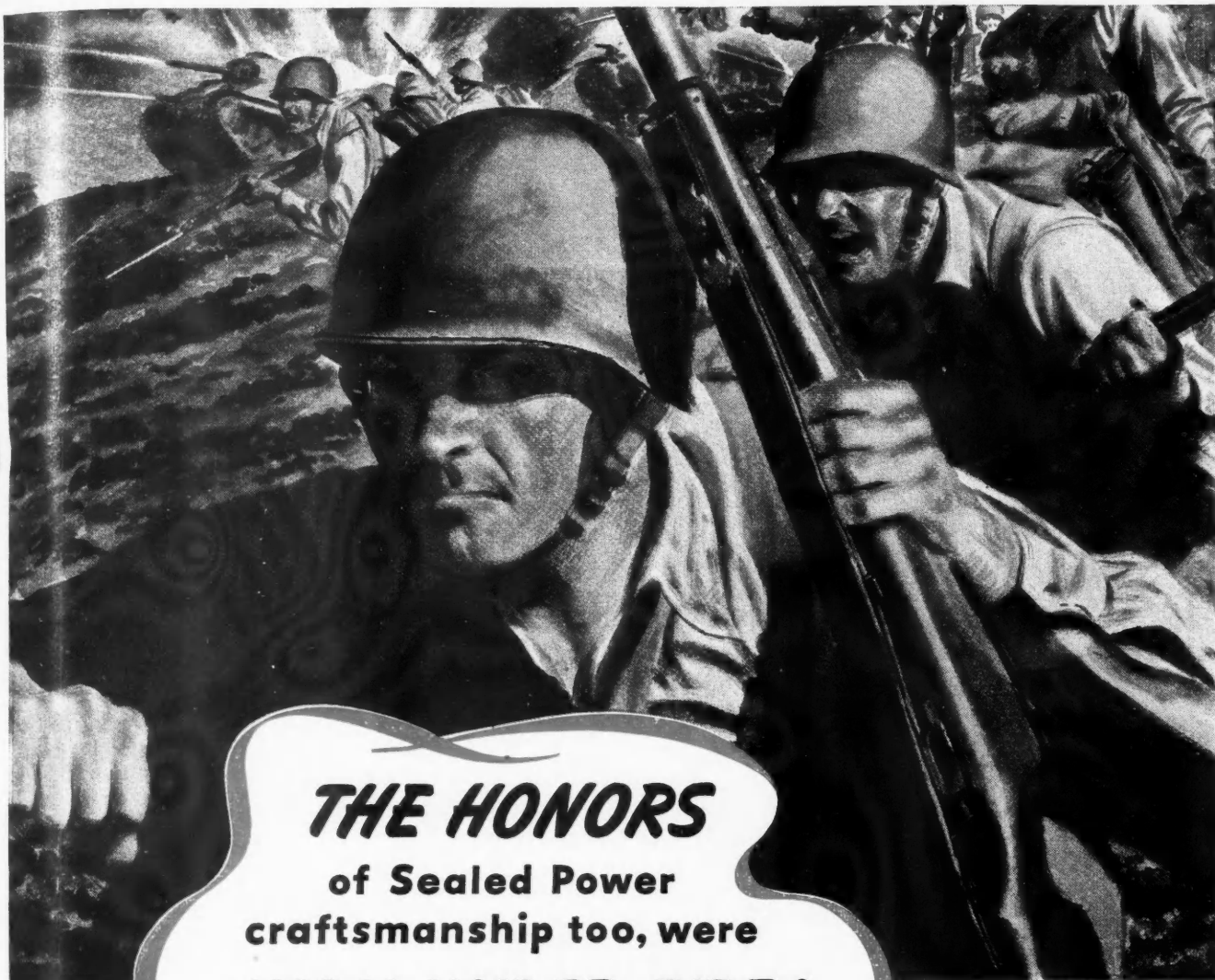
When World War I came to an end, copper, the price of which, after selling at as high as 36 cents a pound, the

Government had "fixed" at 23½ and later at 26 cents, declined in the first post-war years to 12¼ cents. With today's ceiling price at 12 cents, although a premium is paid for some of the "high cost" product, the situation is quite different. If the proposed stockpiling assured to copper consumers all the copper they needed at 12 cents out of post-war production, most of them would consider their interest well protected. What many fear is that "freezing" of the war surplus would not prevent a price rise in the post-war free metal market. While the guns of war are still roaring, it is utterly impossible to appraise the world situation, not only in copper, but in all other non-ferrous metals. That, regardless of cost, continuation, yes even expansion of the war-born tin smelting and refining facilities of the United States, not necessarily under Government administration, however, must form an integral part of a sound post-war metal program, is one of the few points on which there appears to be general agreement.

Losses in steel output caused by blast furnace suspensions resulting

*(Turn to page 76, please)*





***THE HONORS***  
of Sealed Power  
craftsmanship too, were  
***WON UNDER FIRE!***

No engine part faces and triumphs over so tough a task as the piston assemblies, built by the millions, by Sealed Power for every branch of the fighting forces, and for home-front vehicles too. Torturing temperatures, impact shocks, abrasive friction, chemical action, rust and "metal fatigue," must all be fought . . . and vanquished.

That is why Sealed Power men and women are justly proud of their contribution to this "war of engines."

Long years of peace-time service to car, truck and tractor manufacturers made this distinguished wartime record possible. We're thankful for it and proud of it.

**SEALED POWER CORPORATION**

Muskegon, Michigan • Windsor, Ontario



**SCRAP METAL  
IS NEEDED FOR  
EVERY GUN,  
TANK AND  
SHIP. SEND  
YOUR SCRAP  
TO WAR.**

**PISTON RINGS — PISTONS — CYLINDER SLEEVES**

# Supervisory Employees Stage First Foremen's Strike at Ford

*Walkout Was Caused by Dismissal of Three Foremen and Dispute Over Interpretation of Wage Agreement*

First strike by supervisory employees in the history of the automotive industry occurred recently when 9,000 foremen at four Detroit area plants of the Ford Motor Co. walked out to enforce collective bargaining demands. The strike was sanctioned by the Foremen's

Association of America, an independent union claiming 15,000 members in Michigan plants. The FAA was organized at the Ford Rouge plant by Robert H. Keys, association president, and several fellow foremen in 1941. The FAA signed a foremen's wage schedule

agreement with Ford on Nov. 5, 1942.

The Ford foremen's strike was precipitated by a dispute between the FAA and the company over interpretation of the wage agreement on the basic pay for foremen and the dismissal of three foremen by the company. A half page advertisement by the FAA in Detroit newspapers headlined "We Don't Want to Strike" set forth the case at issue. The FAA maintained that the company's interpretation of the wage agreement was 10 cents less per hour than 40 per cent of the Ford foremen were entitled to receive. Posting of the newspaper ad on bulletin boards in the magnesium foundry led to the firing of 28 foremen and this resulted in the spread of the strike to the rest of the Rouge plant and also to the Ford Highland Park, Lincoln and Willow Run Bomber plants.

The foremen established picket lines around the Ford plants but production workers, members of the UAW-CIO, generally ignored them except at the Willow Run plant, where only about half the light Sunday shift reported. R. J. Thomas, president of the UAW-CIO, announced, "Workers of Ford Local 600 will not take foremen's jobs but will continue on their own jobs and will not recognize foremen's picket lines." After two days a truce was arranged between the company and the association by Edwin E. Witte, regional WLB chairman, with assurance that the dispute would be heard by the National WLB, but the strike began again two days later. This time 1,500 foremen walked out at the Rouge plant, charging the company with pulling the cards of 823 foremen, demoting some to production jobs and firing others. Keys said this was in violation of the truce which settled the first strike. Ray Rausch, superintendent of the Rouge plant, issued a company statement saying, "When the time comes, as it apparently has, that these foremen no longer represent management in aiding the company in production that is so vitally needed to win the war, then they are of no further value as foremen." The foremen returned to work a second time after being out a day when the company agreed to take them all back after a conference with the WLB and the Army. Aside from Willow Run, production was not materially affected by the two walkouts.

The FAA has been conducting organizing drives in Detroit plants since early in the year, concentrating on Packard, Detroit Diesel Engine Division of GM and the Ecorse plant of Murray Corp. of America. However, the association has been stymied recently by the NLRB in its decision of May 11 in the Maryland Drydock Case. Reversing an earlier decision, the NLRB held that unions of supervisory employees cannot be recognized as appropriate collective bargaining units. The three-man board panel rejected a petition by the Industrial Union of Marine & Shipbuilding Workers (CIO)

(Turn to page 67, please)

**"IT'S NOT IMPORTANT  
UNLESS IT WILL HELP  
WIN THE WAR."**

**MISTER,  
you said it!**

This is no time for "hair-splitting" or "gingerbread". Chrome trim and plaid upholstery don't fit in with tank-killer turret guns and caterpillar treads.

And *how important* anything is must be measured in terms of "service rendered" where it counts most.

Our product, the VISCO-METER\*, built up quite a service record in government use through pre-war years. Soon after Pearl Harbor our entire production capacity was enlisted to serve with the gasoline and Diesel engines consigned to Uncle Sam's war uses.

A simple 12 ounce piece of mechanical precision the VISCO-METER\* is doing an *important job*—and doing it

well—guarding these needed and costly engines against lubrication failures. No need to go into the importance of lubrication—that's recognized. The important thing is: *only* VISCO-METER\* can tell visually, (via a continually indicating gauge) the viscosity or lubricating value of the crankcase oil while the engine is in operation. Only VISCO-METER\* can warn in advance of failure—preventing damage and loss of service. So the VISCO-METER\* *is important* and is helping to win the war.

In peacetime the VISCO-METER\* will continue to play an important role. If you are looking forward, a VISCO-METER\* engineer can be most helpful.

**VISCO-METER**

CORPORATION

GROTE ST., BUFFALO, N. Y.

\*Fully covered by U. S. and Foreign Patents

# Tools for Machining Aluminum

## FOR GENERAL MACHINE SHOP PRACTICE

**TOOLS** for machining aluminum should generally have more top and side rake than is common for machining steel; the cutting edges should be keen and the tool surfaces should have a smooth, bright finish.

In the following illustrations, a wide range of rake angles is indicated. In general, the larger rake angles are employed for finishing tools and for the aluminum alloys that are not free-cutting; this includes the softer materials which require tools with exceptionally acute and keen cutting edges. On the other hand, rake angles

in the lower range are used for roughing cuts and for machining the alloys that have free-cutting characteristics. Tools similar to those used for machining steel may often be employed successfully.

**TOOL MATERIALS**—High-carbon steels are good for many jobs where the cutting speed is low. High-speed tool steels are better for quantity production. Cemented-carbide-tipped tools are superior to high-speed tool steels, especially for aluminum alloys with a high silicon content.

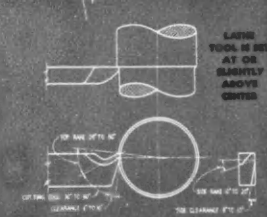
**CUTTING SPEEDS AND FEEDS**—Generally, aluminum can be machined to best advantage by using the highest speed at which the equipment is capable of operating, with moderate feeds and cuts.

**CUTTING COMPOUNDS**—Use a copious amount of cutting compound. Soda water or soluble oil may be used for milling, drilling, and sawing operations. Mineral oil with the addition of 5 to 10 per cent fatty oil, such as lard oil, is an excellent lubricant. A 50-50 mixture of kerosene and lard oil gives excellent results.

### LATHE TOOLS

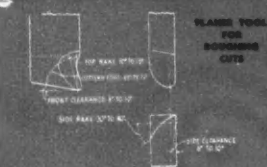


TYPICAL LATHE TOOL AND HOLDER

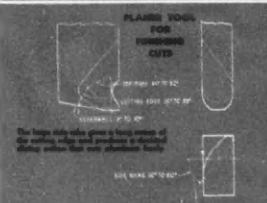


LATHE TOOL IS SET AT AN ANGLE AS SHOWN ABOVE CENTER

### PLANNER TOOLS



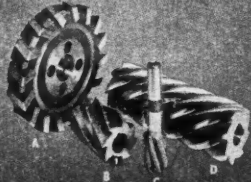
PLANNER TOOL FOR ROUGHING CUTS



PLANNER TOOL FOR FINISHING CUTS

The larger side rake gives a better range of the cutting edge and produces a finished finish surface that is more uniform.

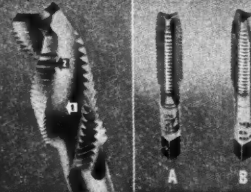
### MILLING CUTTERS



A. Inserted-tooth face milling cutter. B. Solid shank-tooth face milling cutter. C. End mill for milling aluminum. D. Helical milling cutter.

E. The end mill tooth profile "hook" is formed by the side rake. Gears with small side clearance.

### THREADING TOOLS



A. Thread chaser. B. Thread mill.

C. Thread chaser. D. Thread mill.

E. Thread chaser. F. Thread mill.

G. Thread chaser. H. Thread mill.

I. Thread chaser. J. Thread mill.

K. Thread chaser. L. Thread mill.

M. Thread chaser. N. Thread mill.

O. Thread chaser. P. Thread mill.

Q. Thread chaser. R. Thread mill.

S. Thread chaser. T. Thread mill.

U. Thread chaser. V. Thread mill.

W. Thread chaser. X. Thread mill.

Y. Thread chaser. Z. Thread mill.

AA. Thread chaser. AB. Thread mill.

AC. Thread chaser. AD. Thread mill.

AE. Thread chaser. AF. Thread mill.

AG. Thread chaser. AH. Thread mill.

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BG. Thread chaser. BH. Thread mill.

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BJ. Thread chaser. BK. Thread mill.

BK. Thread chaser. BL. Thread mill.

BL. Thread chaser. BM. Thread mill.

BM. Thread chaser. BN. Thread mill.

BN. Thread chaser. BO. Thread mill.

BO. Thread chaser. BP. Thread mill.

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BQ. Thread chaser. BR. Thread mill.

BR. Thread chaser. BS. Thread mill.

BS. Thread chaser. BT. Thread mill.

BT. Thread chaser. BU. Thread mill.

BU. Thread chaser. BV. Thread mill.

BV. Thread chaser. BW. Thread mill.

BW. Thread chaser. BX. Thread mill.

BX. Thread chaser. BY. Thread mill.

BY. Thread chaser. BZ. Thread mill.

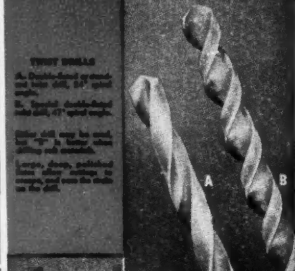
BZ. Thread chaser. CA. Thread mill.

CA. Thread chaser. CB. Thread mill.

CB. Thread chaser. CC. Thread mill.

CC. Thread chaser. CD. Thread mill.

### DRILLS AND REAMERS



A. Twist drill. B. Reamer.

C. Twist drill. D. Reamer.

E. Twist drill. F. Reamer.

G. Twist drill. H. Reamer.

I. Twist drill. J. Reamer.

K. Twist drill. L. Reamer.

M. Twist drill. N. Reamer.

O. Twist drill. P. Reamer.

Q. Twist drill. R. Reamer.

S. Twist drill. T. Reamer.

U. Twist drill. V. Reamer.

W. Twist drill. X. Reamer.

Y. Twist drill. Z. Reamer.

AA. Twist drill. AB. Reamer.

AB. Twist drill. AC. Reamer.

AC. Twist drill. AD. Reamer.

AD. Twist drill. AE. Reamer.

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AJ. Twist drill. AK. Reamer.

AK. Twist drill. AL. Reamer.

AL. Twist drill. AM. Reamer.

AM. Twist drill. AN. Reamer.

AN. Twist drill. AO. Reamer.

AO. Twist drill. AP. Reamer.

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AW. Twist drill. AX. Reamer.

AX. Twist drill. AY. Reamer.

AY. Twist drill. AZ. Reamer.

AZ. Twist drill. BA. Reamer.

BA. Twist drill. BB. Reamer.

BB. Twist drill. BC. Reamer.

BC. Twist drill. BD. Reamer.

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GD. Twist drill. GE. Reamer.

GE. Twist drill. GF. Reamer.

GF. Twist drill. GG. Reamer.

GG. Twist drill. GH. Reamer.

GH. Twist drill. GI. Reamer



*This is a true story of one of the many contacts made by Square D Field Engineers which have resulted in increased production or reduced costs.*



## OBJECTIVE... to reduce 64 man hours to 2

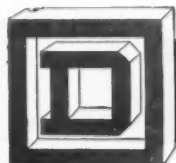
"We're going to build a machine to rivet aircraft wing sections automatically . . . somewhat like a gigantic sewing machine. According to our figures, two men at such a machine should be able to match, in one hour, the full day's work of eight men."

That's what a machine tool builder told the Square D Field Engineer who had been called in as consultant. Given a detailed description of machine operation, Square D's job was to design the intricate electrical control which would put it through its paces.

Teamwork between the Field Engineer, the builder and Square D's factory engineers paid dividends. For when the first of these amazing riveting machines was completed, the electrical control was ready to give it life. Aircraft production could look forward to the end of another bottleneck.

### Let a Square D Field Engineer Help You

You'll find a Square D Field Engineer a source of sound counsel whenever you are confronted with problems of electrical control or distribution. He can help you simplify new jobs and do old ones better. And backing him up in every Square D plant, are design and engineering specialists with complete research and testing laboratories at their command. There are Field Engineers in Square D branch offices in 48 principal United States and Canadian cities.



ELECTRICAL EQUIPMENT • KOLLSMAN AIRCRAFT INSTRUMENTS

# SQUARE D COMPANY

DETROIT

MILWAUKEE

LOS ANGELES

## Business in Brief

*Written by the Guaranty Trust Co., New York, Exclusively for AUTOMOTIVE AND AVIATION INDUSTRIES*

General business activity remains near the indicated peak recorded in May. The *New York Times* seasonally adjusted index for the week ended June 19 stands at 141.1, as against 140.8 for the preceding week and 130.0 a year ago.

Retail buying of summer goods has been well sustained, according to current reports. Department store sales reported by the Federal Reserve Board for the week ended June 26 were 19 per cent larger than in the corresponding period last year, this gain comparing with one of 28 per cent in the preceding week. Sales for the four weeks ended on that date also were 19 per cent larger than a year ago, and the total for the year to date is 14 per cent above the comparable 1942 figure.

Railway freight loadings in the week ended June 26, influenced especially by the coal strike, totaled 760,844 cars, showing a drop of 12.4 per cent from the figure for the preceding week and one of 10.8 per cent from that for the like period of last year.

Electric power production during the same period increased seasonally and was 19.2 per cent greater than a year ago. For the preceding week a comparable gain of 19.4 per cent was reported.

Crude oil production during the week ended June 26 averaged 3,954,900 barrels daily. This figure is 11,250 barrels below that for the preceding week but 235,450 barrels above that a year ago. It is 6 per cent below the output recommended by the Petroleum Administration for War.

The production of bituminous coal for the week ended June 19 was officially estimated at 12,100,000 net tons, as compared with 11,725,000 tons a week earlier and 11,006,000 tons a year ago.

Engineering construction contracts awarded during the week ended July 1 amounted to \$60,148,000, according to *Engineering News-Record*, showing a rise of 12 per cent from the figure for the week before but a decline of 72 per cent below that for the corresponding period last year.

Professor Fisher's index of wholesale commodity prices for the week ended June 25 declined one fractional point from the preceding level, to 111.1 per cent of the 1926 average, as against 106.6 a year ago.

Member bank reserves declined \$138,000,000 during the week ended June 30, mainly because of increases in monetary circulation and in Treasury deposits with the Federal Reserve banks. Excess reserves declined \$90,000,000 to an estimated total of \$1,210,000,000. Business loans of reporting member banks declined \$60,000,000 during the preceding week and stood \$1,290,000,000 below the total a year earlier.

### Paul G. Hoffman Elected Director of U.A.T.C.

Paul G. Hoffman, president of the Studebaker Corporation, was elected a director of the United Air Transport Corp. at the regular monthly board meeting held in Chicago.

# Why SO LITTLE TROUBLE? WITH AUTOMOBILE BEARINGS!



The automobile owner has very little trouble with the bearings in his car. WHY? Because the automotive industry learned years ago to give bearings the best possible protection . . . LUBRICANT

**SEALS of this type**

are used generally by automotive manufacturers to keep lubricant in the bearings and to



exclude foreign matter and moisture. A good bearing with this protection will deliver maximum performance

**CHICAGO RAWHIDE MANUFACTURING COMPANY**

1310 ELSTON AVENUE • CHICAGO, ILLINOIS

64 Years Manufacturing Quality Mechanical Leather Goods

Exclusively and now Sirvane Synthetic Products

PHILADELPHIA • CLEVELAND • NEW YORK • DETROIT • BOSTON • PITTSBURGH • CINCINNATI



## War Plant Expansions

Ford Motor Co. has received increases in three contracts with the Defense Plant Corp. for additional plant facilities in Michigan. A \$3,300,000 increase presumably for the Willow Run bomber plant, will boost the total commitment to \$82,000,000. The other increases are for \$500,000 and \$200,000, respectively. Bendix Aviation Corp. has been granted an increase of \$85,000 for expanding Michigan facilities.

Output of B-24 Liberator bombers by the Consolidated Vultee Aircraft Corp. increased 330 per cent in the

first six months of 1943 over the same period of 1942. Deliveries of Liberators and of Catalina and Coronado flying boats from the San Diego plant increased 31 per cent from Nov. 30, 1942 to May 31, 1943 although personnel decreased 2 per cent. Deliveries from the Fort Worth plant in the same period gained 490 per cent compared to a 96 per cent increase in the worker force, while output at the Wayne, Mich., division rose 1,800 per cent compared to a 70 per cent rise in employment.

Lockheed Aircraft Corp. has placed in operation a new continuously moving assembly line which by September

will double the output of P-38 fighter planes. The new line also will result in a 40 per cent reduction in man-hours of labor per plane.

Brewster Aeronautical Corp. was ahead of schedule on airplane production in April and May and also exceeded schedules, with the exception of one model, in June. Ryan Aeronautical Co. has under construction at San Diego, Cal., a large final assembly building and a new office and engineering building. The assembly structure can be adapted to the manufacture of much larger aircraft than Ryan has produced in the past. Defense Plant Corp. has purchased 8½ acres of land at the Muskegon (Mich.) Co. airport as the site for a \$375,000 aircraft plant to be operated by Brunswick-Balke-Coller Co., Chicago.

## Five Brothers\*..



## ..and an Idea

IT ISN'T OFTEN that an idea created in the minds of boys will materialize in later life. With the five Turner brothers, William, Cort, Frank, Charles, and Robert, their boyhood idea that some day they would be in business together, overshadowed all the obstacles of hard work, and study to make this idea a reality. ★ Finally in April 1939 they purchased their first grinding machine and formed their own company. From this modest beginning they gradually won recognition among manufacturers for precision-built gauges. This recognition made expansion necessary, and today their company occupies one of the most modern buildings for the manufacture of gauges in the country. ★ The Ⓢ stamped on a gauge represents a product backed by the integrity of five brothers and their practical knowledge of precision gauges.

*\*Since May 7, 1942, William Turner, of the U. S. Navy, has been reported missing in action in the Coral Sea Battle.*

*The Stamp Ⓢ of Precision*

**TURNER GAUGE GRINDING COMPANY**

2622 HILTON ROAD • • FERNDALE, MICHIGAN



## Awards

Names of winners of Army-Navy "E" awards in or allied with the automotive and aviation industries, announced since the July 1 issue of *Automotive and Aviation Industries* went to press.

ACE MANUFACTURING CORPORATION, Philadelphia, Pa.  
ATLAS POWDER COMPANY, Reynolds, Pa.  
AUTOMOTIVE MAINTENANCE MACHINERY COMPANY, Chicago, Ill.  
THE BAKER MANUFACTURING COMPANY, Springfield, Ill.  
THE BASTIAN-BLESSING COMPANY, Chicago, Ill.  
THE CARBORUNDUM COMPANY, Niagara Falls, N. Y.  
THE CINCINNATI GEAR COMPANY, Cincinnati, Ohio.  
THE E. D. CLAPP MANUFACTURING COMPANY, Auburn, N. Y.  
DETROIT GASKET & MANUFACTURING COMPANY, Detroit, Mich.  
DIAMOND CALK & HORSESHOE COMPANY, Duluth, Minn.  
THE DOW CHEMICAL COMPANY, Pittsburg, Cal.  
E. I. du PONT de NEMOURS & COMPANY (two plants).  
EASTERN ROLLING MILLS, Baltimore, Md.  
FAY AND SCOTT, Dexter, Maine.  
GENERAL ELECTRIC COMPANY, Plastics Dept., Pittsfield, Mass.  
GENERAL INSTRUMENT CORPORATION, Elizabeth, N. J.  
HANNIFIN MANUFACTURING COMPANY, Chicago, Ill.  
HERCULES POWDER COMPANY, Hercules, Cal.  
HEYWOOD - WAKEFIELD COMPANY, Gardner, Mass.  
JACOBS MANUFACTURING COMPANY, West Hartford, Conn.  
JOHNS-MANVILLE PRODUCTS CORPORATION, Lompoc, Cal.  
LISLE CORPORATION, Clarinda, Iowa.  
TAYLOR INSTRUMENT COMPANIES, Rochester, N. Y.  
WORTHINGTON MOWER COMPANY, Stroudsburg, Pa.  
ZOLLNER MACHINE WORKS, Fort Wayne, Ind.



# ***There's Stamina and Performance***

**with**

## **McQUAY-NORRIS**

**ALUMINIZED**

## **PISTON RINGS**

### **PISTONS..PINS..**

### **HARDENED & GROUND PARTS**

McQuay-Norris, a pioneer manufacturer of parts in the automotive field, is devoting itself in increasing measure to the aviation industry. Our Aircraft Division projects the McQuay-Norris policy of clinical research into this important field with the result that we are continually adding to available parts, technical assistance and research experience. Your inquiries are invited.

#### **PARTS FOR AIRCRAFT ENGINES**

Piston Rings  
Oil Sealing Rings  
Supercharger Rings  
Carburetor Parts  
Machined Aluminum Pistons  
Piston Pins  
Counterweight Cheek Pins  
Machined Magnesium Parts  
Cylinder Hold Down Nuts  
Hardened and Ground Parts

#### **PARTS FOR PROPELLER ASSEMBLY**

Machined Magnesium Parts  
Piston Rings

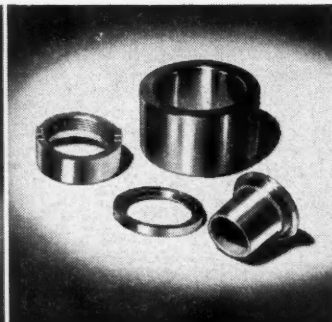
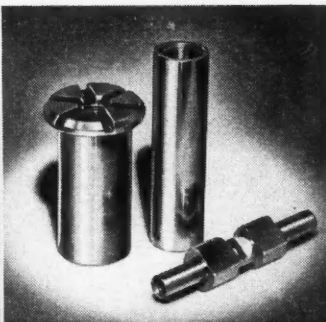
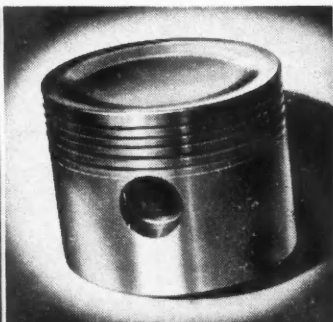
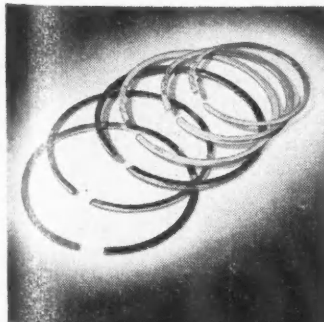
#### **EQUIPMENT FOR MAINTENANCE OF AIRCRAFT**

Pistons for Oxygen Compressor  
Piston Rings for Oxygen Compressor  
Pins for Oxygen Compressor  
Pistons for Air Compressor  
Pins for Air Compressor  
Piston Rings for Air Compressor

#### **LANDING GEAR PARTS**

Machined Aluminum Pistons  
Piston Rings  
Hardened and Ground Parts

**PRECISION WORKERS IN IRON, STEEL, ALUMINUM, BRONZE, MAGNESIUM**



**McQUAY-NORRIS MFG. CO. (AIRCRAFT DIVISION), ST. LOUIS, U.S.A.**  
CANADIAN PLANT, TORONTO, ONTARIO

## All-Woman Factory Now in Production

The first aviation plant in this country manufacturing engine and propeller parts to make 100 per cent use of women in its basic manufacturing operations is Northern Aircraft Products Division of The Aviation Corp. at Toledo, Ohio, it was revealed by William F. Wise, executive vice president of AVCO, in announcing that manufacturing has started at the Northern unit. As Northern Aircraft builds its production up to maximum capacity, the 100 per cent use of women in basic operations now in effect will be maintained, Mr. Wise

stated, because in the future, as well as now, men will be employed only as job-setters, supervisors and instructors.

This exclusive use of women on production work is unique in that the whole factory setup has been developed from the beginning on this basis of 100 per cent women for that work. The decision was made by this Division, which manufactures precision parts for aircraft engines and propellers, in view of the current need for men in our armed forces. The success of the women in handling even the most exacting precision machining operations at Northern is said to have completely justified the decision.

## Advisory Committee Appoints Members

Appointed members of the Gasoline Carburetor Industry Advisory Committee of WPB are R. C. Allen, Zenith Carburetor Division of Bendix Aviation Corp.; S. W. Gray, Marvel-Schebler Carburetor Division of Borg-Warner Corp.; Howard W. Linkert, L. & L. Mfg. Co., Indianapolis; C. D. Marhart, Bendix Products Division of Bendix Aviation Corp.; Harold R. Schausten, Tillotson Mfg. Co., Toledo; Walter H. Weber, Detroit Lubricator Co.; Hugh H. C. Weed, Carter Carburetor Co., and B. W. Westcott, Holley Carburetor Co.

## Advertising Notes

Frederic I. Lackens, Advertising Manager of The Hays Corporation, Michigan City, Indiana, was elected President of the National Industrial Advertisers Association, Inc. at their annual election of officers held in conjunction with their Central Regional Wartime Conference at the Hotel Statler, Cleveland, Ohio.

## Balancing Propeller Blade in New Pennsylvania Plant of Curtiss-Wright Corp.



Before Curtiss hollow steel propeller blades reach final assembly, they must be so accurately balanced that a small piece of paper placed on the blade tip will cause it to revolve. This precision balancing operation is one of the most important stages in the production of Curtiss electric hollow steel propellers.

# BUELL AIR COMPRESSOR

**B**UELL Air Compressors are used on bomber and fighter planes to operate brakes and machine guns. Here, where reliability is of first importance, their fine workmanship and precision manufacture pay real dividends in dependable operation. 12 years of operation on cars, trucks, buses, boats and railway trains was the proving ground for their adoption as an aviation accessory.

**B**UELL Air Compressors can be operated at speeds of 2000 to 3400 R.P.M. Pressures in excess of 225 pounds are built. Safety control of air pressure is automatically handled by Buell design and retention of air is assured thru precision valve construction. Self contained oiling, bronze connecting rod and bearings. Moving parts are held to a tolerance of .0002".

ACTUAL  
SIZE  
•  
WEIGHT  
5 LBS.

DISPLACE-  
MENT  
1.2 CU. FT.  
AT 3500  
R.P.M.

AVAILABLE

ON PRIORITY

## BUELL MANUFACTURING CO.

Dept. AA, 2975 COTTAGE GROVE AVE., CHICAGO, ILL.

# Specify SHEFFIELD ARMY-NAVY

## AERONAUTICAL TAPER PIPE THREAD GAGES

★ ★ ★

All styles of Taper Pipe Thread Gages included in Specification AN-GCG-P-363 for the inspection of aircraft fuel and oil line connections, are available from Sheffield.

Write for Bulletin #43-1 describing the use of one and three-step  $L_1$  and  $L_3$  plugs, 6-step plain plug,  $L_1$  and  $L_2$  thread rings, the 6-step plain ring—and other gages used in aircraft parts inspection.

*$L_1$  Taper pipe thread plug Nitrigage 3-step, Style 1005.*

*$L_1$  Taper pipe thread ring Nitrigage 3-step, Style 1002.*

*$L_1$  Taper pipe thread plug Nitrigage 6-step, Style 1003.*

*$L_1$  Taper pipe thread ring Nitrigage 6-step, Style 1001.*

*Plain taper ring Nitrigage 6-step, Style 1007.*

*Plain taper plug Nitrigage 6-step, Style 1006.*

*$L_1$  Taper pipe thread plug Nitrigage single-step, Style 1004.*

**SHEFFIELD**  
MASTER GAGEMAKERS

**THE SHEFFIELD CORPORATION**  
*Dayton, Ohio, U.S.A.*



## Bendix Advances in Hydraulics Field

Eleven of the 12 aircraft hydraulic products now manufactured by Bendix Aviation, Ltd., of North Hollywood, Calif., have been declared standard Army-Navy equipment and official action on the twelfth is pending.

In making the disclosure, Palmer Nicholls, president said Bendix "is a near second if not actually second in hydraulic production volume nationally and has more equipment standardized than any company in the field."

Recognition of Bendix position in hydraulics is seen in the fact that the

firm now is furnishing 21 of 22 major U. S. aircraft companies with equipment for use on military planes of 59 different types.

Among the orders received recently, according to R. C. Fuller, contract director, was one of \$500,000 for pressure accumulators from a producer of long range bombers.

One of Bendix contributions to the hydraulics field has been the development of plastic poppets for valves. The success of their use has been due to sealing qualities under high pressure. Plastic poppets are used in check valves, pressure relief valves, four-way selector valves, hand pumps, pressure regulators and numerous other apparatus.



## Here's Your Guide to Lower Wheel Dressing Costs!

Of course you will want to know more about this new Tru-Line Principle of wheel dressing! The coupon below will bring you the facts about Tru-Line multiple-diamond Tools for straight, profile and step dressing operations—the tools that are amazing production men by their accuracy, their ability to speed production, and by the almost unbelievable savings in time and production costs they are accomplishing.

**SEND FOR THIS  
NEW BOOK  
TODAY!**

Name \_\_\_\_\_  
Company \_\_\_\_\_  
Address \_\_\_\_\_  
City \_\_\_\_\_ State \_\_\_\_\_

**WHEEL TRUEING TOOL CO., INC.**

3200 W. DAVISON AVENUE \* DETROIT, MICHIGAN

**DIAMOND TOOLS for** STRAIGHT, FORM, THREAD AND RADIUS DRESSING;  
TURNING • BORING • GAGES • CORE DRILLING

## CALENDAR

### Conventions and Meetings

SAE Nat'l Tractor Mtg., Milwaukee, Sept. 23-24  
SAE Nat'l Aircraft Engineering & Production Mtg., Los Angeles, Sept. 30-Oct. 2  
National Safety Congress, Chicago, Oct. 5-7  
American Welding Society, Chicago, Oct. 18-23

### Obituary

David E. Ross, 71, inventor and manufacturer of the Ross steering gear, died June 28 after a long illness. He was for many years vice president and general manager of the Ross Gear and Tool Company, LaFayette, Ind. until 1927 when he retired and became chairman of the board.

Howard Jones, 47, who had been associated with the White Motor Company since 1924, died June 27 at Cleveland, following a heart attack. Mr. Jones became shop engineer at White in 1928, assistant production manager in 1936, general superintendent, factory manager and vice president in charge of production in 1937.

William A. Tryon, president of The Trayer Products, Inc., died June 20 in Elmira, N. Y.

William E. Sykes, well known authority on gears and inventor of the Sykes continuous tooth herringbone gear, died June 19 in England. Mr. Sykes was formerly associated with Farrell-Birmingham Company at its Buffalo plant, but for the past six years has been in England operating his own plants, W. E. Sykes, Ltd.

Bradley W. Stickney, 58, assistant purchasing director of the Melrose Park plant of Buick Motor Division, General Motors Corp., died June 25 at Oak Park, Ill., after a short illness. He had been with Buick for 30 years, formerly serving as assistant purchasing director in Flint.

Earle D. Parker, 63, vice president and general works manager of the Barber-Colman Company, Rockford, Ill., died June 12 a few minutes after being stricken with a heart attack. For 40 years, Mr. Parker had been employed in the engineering and management divisions of the Barber-Colman Company and for the past 20 years had served as general works manager. He became vice president of the firm following Mr. Colman's death last fall.

James E. MacMurray, 80, founder and former chairman of the board of Acme Steel Company, Chicago, died July 1 at Pasadena, Cal. Mr. MacMurray held the presidency of Acme Steel Company for 38 years and then became board chairman until his retirement several years ago.



*then I said  
to myself—*



## **So... the Nazis couldn't sink her!**

This 12,500-ton, all-welded tanker "Victoria" was torpedoed amidships. Her deck plates buckled but her bulkheads held. Then, the baffled Nazis smashed a second torpedo into her and left, confident she was finished. But those welds refused to yield—even to Nazi TNT. She made it to port and was repaired—ready for the subs again. Some ship, I say!

*Some construction, you mean! This is just one of many welded ships that have refused to be licked by torpedoes. Just like our welded M-4 tanks which withstood the Nazi 88's in North Africa. Ships, tanks, planes and*

*guns—they're all welded for strength as well as for savings in time and materials.*

*Better products and lower costs—just what I want in my business after the war. Then why shouldn't I weld my peace-time products?*

*You should! You MUST if you plan to survive in the face of war-developed ideas. And believe me, your ship of business will sink or float, depending on how well you can stand up against competition on WELDING ECONOMY. Why not start NOW to learn from Lincoln the latest kinks in welding thrift.*

**THE LINCOLN ELECTRIC COMPANY, CLEVELAND, OHIO**

## MEN . . . . .

**John R. Bangs**, formerly head of the dept. of administrative engineering at Cornell University, has been named general manager of industrial and personnel relations of the E. G. Budd Mfg. Co.

**Thomas A. Morgan**, president of the Sperry Corp., has been awarded the honorary degree of doctor of engineering by the University of North Carolina.

**Alvin J. Herzig**, chief metallurgist, has been elected vice president in charge of research of Climax Molybdenum Co. He succeeds **William P. Woodside**, who is retiring after 17 years with the company.

**Dr. R. P. Dinsmore**, formerly development manager of Goodyear Tire & Rubber Co.,

has been elected vice president in charge of research and development. He served as assistant deputy director of the government's synthetic rubber program until May.

**Henry Ford** has taken over the duties of general manager of the Ford Motor Co. as well as the presidency, which he assumed in June after the death of his son, Edsel B. Ford. **Frank Campsall**, formerly secretary to Henry Ford, has been appointed assistant general manager. **Harry H. Bennett**, director of personnel, has been named an assistant to Vice President **C. E. Sorensen** in charge of administrative problems, while **Ray R. Rausch**, superintendent of the Rouge plant, has been named Sorensen's assistant in charge of production. **Stanley Fay**, assistant to Bennett, will take over the personnel duties. **Claude M. Melles** and **Howard Kellogg** have been designated co-directors of purchasing.

**Robert H. Wendt**, chief engineer, and

**Kenneth W. Tibbits**, production manager, have been elected vice presidents of Taylorcraft Aviation Corp.

**Sparks E. Bonnett**, Los Angeles tire distributor, has been appointed chief of the Tire Rationing Branch of OPA, succeeding **Robert S. Betten**, who has been commissioned a lieutenant in the U. S. Navy.

**Ed G. Bern**, formerly Washington representative and sales manager, has been named general manager of Hughes Aircraft Co., Culver City, Cal. He will supervise construction of the Hughes-Kaiser HK-1 cargo-carrying flying boat.

**Benson Ford**, a director of the Ford Motor Co., has been elected a director of the Manufacturers National Bank, Detroit, succeeding his father, the late Edsel B. Ford.

**Richard Gauen**, director of the press bureau of Nash-Kelvinator Corp., has been commissioned an ensign in the U. S. Naval Reserve. In expanding its public and industrial relations activities, the corporation has appointed associate directors of public relations. They are **Millard Faught**, formerly head of the marketing reports division of the 12 northeastern states for the War Food Administration, and **William Haworth**, formerly public relations director of the Austin M. Fisher Organization, New York City.

**John L. Rogers**, formerly director of the ODT Division of Motor Transport, has been named assistant director of ODT. **Harold C. Arnot**, ODT regional motor transport manager at San Francisco, will succeed Rogers as director of the Division of Motor Transport.

**Omer L. Woodson**, vice president and assistant general manager of Bell Aircraft Corp., has taken direction of all activities of the new Bell Bomber Plant at Marietta, Ga.

**Albert E. Reiter** has been appointed assistant secretary and assistant treasurer of the Autocar Co.

**C. N. Suffill**, for the past six years director of advertising and public relations for the Lincoln Aeronautical Institute, has rejoined United States Rubber Company as head of the business development department of the Fiske Tire Div.

**Major Lester D. Gardner** has been elected chairman of the council of the Institute of the Aeronautical Sciences. **Bennett H. Horschler** was elected executive vice president to succeed Major Gardner and **George R. Forman** was elected assistant to the President, **Dr. Hugh L. Dryden**, of the Natl. Bureau of Standards.

**Robert L. Coe**, vice-president of the Chase Brass & Copper Co. Inc., was re-elected president of the Copper & Brass Research Assoc.

Announcement has been made of the formation of an Aircraft Section of Johns-Manville's Industrial Dept. and the appointment of **William S. Hough** as manager of the dept.

Lemeco Products, Inc., has announced the following promotions: **J. S. Longdon**, sales manager, and **Frank J. Schwab**, factory equipment manager, to the posts of vice presidents.

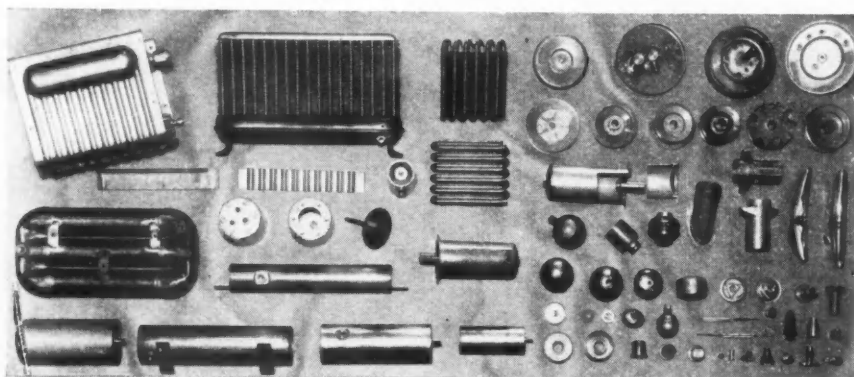
**Kenneth J. Wilson**, for the past several years contract coordinator of Aircraft Components, Inc., has been made vice president in charge of technical service for Smith-Mautz, Inc.

**Roy W. Paton**, Perfect Circle Replacement Engineer, has been elected chairman of the Indiana Section of the Society of Automotive Engineers.

Appointment of **George M. Muschamp** and **Paul L. Goldstroom** as vice presidents of the Brown Instrument Co., a subsidiary of Minneapolis-Honeywell Regulator Co., has been announced.

**Harry G. Sparks**, at a recent meeting of the board, was named president and general manager of Sparks-Withington Co. **Winthrop Withington** was named chairman of the board, **Clifford M. Sparks**, vice president, **W. J. Corbett**, vice president. **David L. Johnson**, secretary, and **H. M. Johnston**, treasurer.

(Turn to page 64, please)



Some parts and products joined by the electric furnace copper brazing process—assemblies ranging in size from small metal radio tube parts to large automotive and refrigerator units are joined neatly, securely and economically by this process.

## Design Your Metal Parts For Copper Brazing

Miscellaneous steel assemblies are joined 60% to 75% faster at 1/4 the former labor cost by the copper brazing process.

"Greatly improved results—neater, stronger joints—60 to 75% faster, at about one quarter the former labor cost," that briefly is the report received from the production manager of a prominent midwestern plant after installing an EF continuous copper brazing furnace for joining some of their steel assemblies.

Within a month after installing their first brazing furnace, a second similar but larger furnace was ordered for joining other products—both furnaces are now operating side by side, joining all kinds of assemblies—large and small—neatly, economically and securely.

Products difficult or expensive to make in one piece can be made in several pieces and joined—thus not only reducing the cost but actually improving the quality and appearance. Products requiring several stampings joined or requiring screw machine parts, forgings and stampings to complete the unit, can be neatly and economically joined right in the production line in your shop. Strong, leak-proof joints are made and the completed unit is discharged from the furnace—clean and bright.

Any number of joints in the same product or any number of pieces can be joined at one time. The most intricate parts or assemblies are made to actually "grow together," and joints made which are as strong, or even stronger than the original parts.

Investigate the brazing process for your products. With slight changes in design you may be able to join your metal assemblies, neater, cheaper and stronger by this method.

Send for printed matter showing various types of EF copper brazing furnaces. Investigate the Copper Brazing Process For Joining YOUR Metal Parts

## The Electric Furnace Co., Salem, Ohio

Gas Fired, Oil Fired and Electric Furnaces—For Any Process, Product or Production



**Soaring on wings of war,** crystal-clear transparent Du Pont "Lucite" methyl methacrylate resin sheeting provides many of America's greatest battle planes with dependable, light-weight enclosures, allowing pilots maximum vision under all conditions.

Shown on these pages are some of the many warplanes now using "Lucite." These pictures will tell you more conclusively than words how Du Pont "Lucite" is proving its mettle on our battlefronts all over the world... and how, when peace comes, this versatile acrylic plastic will be ready to serve designers, engineers and manufacturers in more new and unusual ways than ever before have been dreamed.



**GET THIS FREE BOOKLET!** Du Pont's new 114-page Manual on "Lucite" clearly describes the fabricating, forming, mounting, installing and repairing of "Lucite" in its application to aircraft. Plus 38 pages on mechanical, thermal and miscellaneous properties to aid aircraft designers, engineers, production men, and their established enclosure suppliers. For your *free* copy, write on your business letter-head to: E. I. du Pont de Nemours & Co. (Inc.), Plastics Department F, Arlington, N. J. . . . or, 5801 So. Broadway, Los Angeles 3, California. In Canada: Canadian Industries Limited, Montreal.



**FLEET AND SURE**, the Douglas Havoc attack bomber mounts enclosures of Du Pont "Lucite" on its many operations over Axis soil. Half as heavy as duraluminum, one-sixth the weight of steel, "Lucite" often has allowed changes in design to cut load.

**THUNDERBOLTS**, built by Republic, fly with cockpit enclosures of "Lucite" into the Battle of Europe. Easily formed into smooth shapes, enclosures of "Lucite" conform to streamlined contours.



# "LUCITE"

## Methyl Methacrylate Resin

BETTER THINGS FOR BETTER LIVING  
...THROUGH CHEMISTRY

## PUBLICATIONS

Hanna Engineering Works has announced the publication of a new 32-page catalog on **Hydraulic Cylinders**, which offers data of interest to engineers. It includes mounting arrangements, schematic drawings and dimensions of each model, velocity of piston alignment charts and a chart of capacities, data on the cushioning of cylinders and Hanna quick acting handoperated and footoperated valves.\*

W. F. and John Barnes Co. has published a new circular describing its 445 **Two-Spin-Idle Deep Hole Cylinder Boring Machine**. In addition to the description the circular is illustrated with photographs showing different views of the machine, a table of

specifications and drawings showing the tooling set-ups.\*

A new issue of **Tin and Its Uses** has just been published by The Tin Research Institute. It contains an article on tin in bearing alloys; a discussion of the future of tin in some of its major uses (tinplate and solder), with particular reference to the effect on post-war markets of the substitutes and modified techniques which have been adopted to meet the tin shortage.\*

The R. W. Cramer Co. has just issued a new catalog, **Timers, Relays, Switches**, which describes the function of the many different types of timers.\*

Revolator Co. has issued a new folder illustrating and describing their line of **hydraulic freight elevators**. Included are many illustrations of interesting installations.

United States Rubber Co. has announced the publication of a handy chart which

gives, at a glance, the equivalent of fractions in four-point decimals.\*

Universal Wheel & Abrasive Corp. has issued a booklet describing and illustrating its **Nubon Grinding Wheels**. Price lists of the various types are included, together with a chart showing grinding wheel markings.\*

Harnischfeger Corp. has published a new bulletin on the **WSR (Welding Service Range)** method of rating welding machines. The principle of WSR rating and how it differs from nominal ratings is described in non-technical language.\*

A 12-page bulletin summarizing the properties of **Ucilon**, a new surface coating material, has been issued by United Chromium, Inc. It illustrates many essential uses and suggests many more where corrosion is a costly and time consuming problem, or where Ucilon can be used in place of more critical materials.\*

A new two-color booklet on **surface condensers** has been issued by Ingersoll-Rand Co. It is well illustrated and includes numerous cross-sectional views. Subjects discussed are structural and design features; steam penetration; air removal equipment, etc.\*

A new 12-page booklet on **radiant heat drying lamps** has been announced by Westinghouse Electric & Mfg. Co. It tells what radiant heat is and discusses its advantages.\*

Bulletin 502, illustrating **Hammond Cylindrical Grinding, Polishing and Buffing Machines** has been announced by Hammond Machinery Builders. It describes and features the relatively standard unit which can be adapted either for use with grinding, polishing and buffing wheels, or arranged for contact-wheel and abrasive belts with Hammond's new patented backstand-idler.\*

Copperweld Steel Co. has announced the publication of a new Handbook on its **Coppco Tool Steels**. A feature of the book is a section on the descriptions, working suggestions and demonstration photographs for the ten Coppco Tool Steels. A shop chart is also included which lists many common tool applications and recommendations for selection of the proper steel. Tables on fractions and decimal equivalents, hardness conversion, etc., are also included.\*

A portfolio of forty large illustrated charts on **Dimensional Control—Theory and Industrial Application**, for use in classroom training of inspectors is now available from The Sheffield Corp. The charts, 27 x 32 inches, are bound between two heavy covers and cost \$3.50 for the set.\*

Catalog No. 901, covering the Series 900 and Series 1000, **South Bend Turret Lathes** has just been published by South Bend Lathe Works. It describes and illustrates all of the lathes available in both series. Specifications, dimensions, capacities, speeds and feeds are tabulated in the catalog for easy reference.\*

\* Obtainable through Editorial Dept., Automotive and Aviation Industries, Chestnut and 56th Sts., Philadelphia 39. In requesting any of these publications, please give date of issue, your company connection and position.

## MEN

(Continued from page 60)

Norbert J. Brennan has been appointed director of traffic of Chrysler Corp., to replace N. D. Hoke, deceased.

Jessop Steel Co. has announced the appointment of **Fred J. Wood** as district manager of Jessop Steel Co., Ltd., Toronto.

C. B. Cook has been made vice president in charge of advertising, sales promotion and export sales of Elwell-Parker Electric Co., according to a recent announcement by the company.

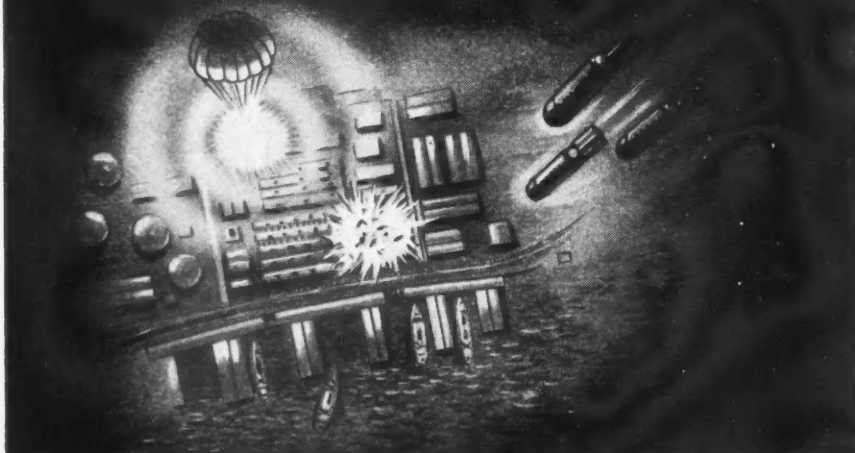
Warren D. Anderson, for more than five years a member of the engineering staff of Norma-Hoffmann Bearings Corp., has been made assistant to the chief engineer.

# RIGHT ON THE TARGET!

## WITH McALEER MILITARY PYROTECHNICS

... Quality Controlled Finishing  
Materials ... Other Vital War Products

Military pyrotechnics alone are not all of the war time products of the McAleer Manufacturing Company — there are others which extend into the fields of military aeronautics and hydraulics — embrace complete industrial finishing materials — metal and plastic — with a helpful advisory service — yours to command.



**McAleer** **MANUFACTURING CO.**  
*Quality-Controlled Finishing Materials*  
ROCHESTER, MICHIGAN

## First Foremen's Strike

(Continued from page 50)

to merge the supervisory employes with the existing contractual unit of production employes or to establish a separate unit.

The 2-1 majority decision held, "We are now persuaded that the benefits which supervisory employes might achieve through being certified as collective bargaining units would be outweighed not only by the dangers inherent in the commingling of management and employe functions but also in its possible restrictive effect upon the organizational freedom of rank-and-file employes."

The FAA is continuing its fight for collective bargaining recognition before the National WLB despite the adverse NLRB decision. Its position is bolstered by the recent statement of Harry A. Millis, chairman of the NLRB, who did not concur in the Maryland Drydock decision and stated that "any attempt to frustrate the legitimate desire of such groups for self-organization to protect their collective bargaining rights can only be harmful to the cause of good industrial-labor relationships and efficient production."

Three unauthorized strikes occurred in automotive plants in the first week after passage of the War Labor Disputes Act (Smith-Connally-Harness Anti-Strike Bill) by Congress over President Roosevelt's veto. A six-day layoff of a UAW-CIO shop steward for insubordination and countermanding the orders of management resulted in an eight-hour protest walkout by 2,200 employes at the Chrysler Highland Park plant. The strikers, who returned to work after urging by union local officials, charged that the steward already had been reprimanded by his superintendent, so the suspension placed him in "double jeopardy." Commenting on the new anti-strike law, which provides that there shall be no cessation of work during a 30-day cooling off period when conciliation efforts are made between the parties, a Chrysler striker said, "Congress passed a prohibition law and it wasn't enforced. This new law is the same thing. We don't care how many congressmen thought it was a good idea. Congress can't go against the will of the people."

There also was a 14-hour strike at the Ford Lincoln plant in Detroit, where 1,600 walked out in protest over a company decision to set back the start of the afternoon shift by 30 minutes to 4 p.m. The employes claimed the change would upset transportation conditions. Three leaders of the unauthorized strike were meted out one-week suspensions at a management-union conference. Another short walkout affected 800 employes at the Port Huron Wire Division of Electric Auto-Lite Co., where they protested pay-rates for new workers.

Commenting on the anti-strike law,

Thomas said as president of the UAW-CIO, "Congress has made a big mistake by not giving this matter more mature consideration. With the efforts labor has put forth in the war so far, this law is rank discrimination against labor. It is becoming increasingly apparent that labor is not getting credit for the job it is doing in winning this war." However, there was no evidence that the UAW-CIO would officially rescind its no-strike pledge although a court fight on the act's legality seems assured.

An interim agreement between the UAW-CIO and General Motors Corp., will enable the payment this summer of

more than \$20,000,000 in vacation pay allowances to more than 300,000 hourly rated GM employes. Workers with one year's seniority will receive 40 hours' pay, or an average of \$44.60, while those with five years' seniority will get 80 hours' pay, or an average of \$92.80. The UAW-CIO's demand for a liberalization of vacation allowances, asking that they be based on a 48-hour week and that employes with six months' seniority qualify for bonus payments, will go to the National WLB for decision, along with demands for equalization of wage rates and creation of a post-war reserve fund for the unemployed.



### TRIPLE DUTY

3 Interchangeable Center Pieces. For all centered and uncentered work.

### 1-IDEAL LIVE CENTERS



TAKE DEEPER CUTS AT HIGHER SPEEDS

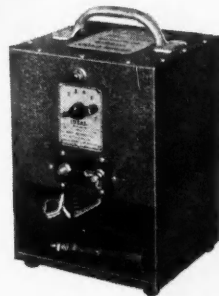
IDEAL Live Centers not only permit deeper cuts at higher speed, but carry heavier loads, because the IDEAL Live Center rotates with the work. Radial load carried by high precision ball bearings, thrust load absorbed by high precision taper roller bearing. All parts hardened and ground.

### 2-IDEAL METAL ETCHER

Permanently Marks Tools, Dies, Parts, Gages, etc.

New, all-purpose Etcher for permanently marking smooth-surfaced iron, steel and their alloys. 14 Heats. Etches legibly, easily, permanently, regardless of the hardness of the metal. Ground clamp for etching large, heavy parts and castings.

MOST COMPLETE LINE OF MARKING TOOLS



### 3-IDEAL DEMAGNETIZER

Keeps Tools Sharp Longer

Quickly demagnetizes work held in magnetic chucks, tools, drills, punches, dies, etc. Abrasive particles disappear after a single pass across the magnetic poles. For small or large work. Demagnetized tools cut faster because they do not bind, heat and dull quickly.



### FREE—

Machine Tool Accessory Catalog gives information on these and many other time-saving tools.

**IDEAL Sycamore**

★ IDEAL COMMUTATOR DRESSER CO. ★

3000 Park Avenue

SALES OFFICES IN ALL PRINCIPAL CITIES

Sycamore, Illinois





## EVOLUTION OF A TURNBUCKLE END...



### THE "AIRCRAFT STANDARD PARTS" WAY

The first step shown above is the key to why Aircraft Standard Parts turnbuckles are better and stronger. Note that our turnbuckle ends are machined from *forgings*, providing not only economy of material and machining time, but also assuring proper distribution of grain structure in the material to assure maximum strength through proper stress distribution. Available in a wide variety of standard types and sizes. Write for special bulletin on "Aircraft Turnbuckles."

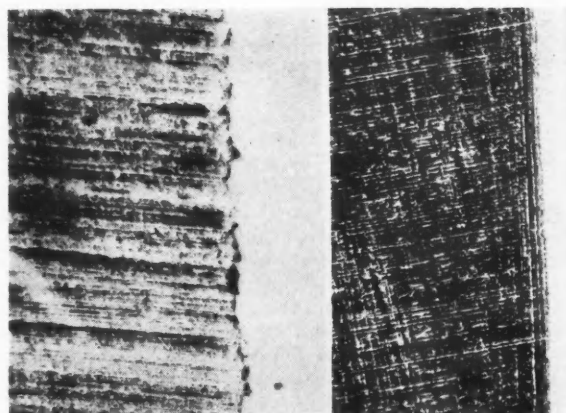
**AIRCRAFT STANDARD PARTS CO.**

1711 19th Ave., Rockford, Illinois

## A New Method of Tool Finishing

A GREAT increase in tool life and resulting conservation of the strategically-important metals tungsten, cobalt and molybdenum is claimed by the Wright Aeronautical Corp. Paterson, N. J., for a new method of tool finishing. Tests extending over a period of months, during which more than 100,000 alloy-steel forgings were machined, are said to have shown that the life of high-speed steel lathe tools can be multiplied as much as 20 times by grinding and honing the cutting tools to a highly-polished mirror finish and by using a new form of tool to break up the chips and shavings.

Very little high-speed steel is used up in actual cutting operations, most of the loss occurring while the tools are sharpened after they have been dulled by use. Instead of being ground by hand, the tools are ground automatically, 18 at a time, on special fixtures. Additional fixtures hold the tools singly for a



final grind on a very fine stone, and this is followed by the ultra-fine polishing operation. The difference between a hand-ground tool and one ground by the new precision grinding process is shown by the accompanying photomicrographs. Under the microscope the edge of a hand-ground tool (left) appears to have a saw-tooth-like profile. In use, the metal from the forging being cut is forced through the crevices of the cutting edge non-uniformly, whereby stress concentrations and local overheating are produced, which in turn cause a rapid breakdown of the cutting edge. Precision grinding on fine stones, followed by precision honing, produces an edge as shown in the illustration (right), which distributes the cutting load equally. The new form of the tool is said to break the chips up into short, small pieces.

### Marking Standard for Gas Cylinders

Manufacturers and users of compressed gases now may request that cylinders for holding gases of different types be marked according to the new American Standard method. A copy of the American Standard Method for Marking Compressed-Gas Cylinders to Identify Content can be

obtained from the American Standards Association, 29 West 39th Street, New York, for 10 cents. A wide variety of gases are compressed and sold in cylinders, and some of these when mixed with other gases may create fire, explosion and health hazards. It is therefore important that all such cylinders be marked in a legible manner, so that there is no danger of different gases being mixed accidentally. Each gas producer usually paints all of the cylinders belonging to him the same color, regardless of the gas contained, and it is therefore important that some standard method of marking be used by which the contents of the cylinders can be easily and positively recognized. The magnitude of the problem may be judged by the fact that in 1940 there were no less than 40 million cylinders in use in this country. The new standard provides that compressed gas cylinders shall be legibly marked to identify the chemical or the trade name of the gas by means of stencilling, stamping or labelling, the height of the lettering being specified in terms of the cylinder diameter. Wherever practical, the marking is to be on the shoulder of the cylinder, and it must not be readily removable.

## Electromagnetic System of Fuel Injection

**A**N ELECTROMAGNETIC system of fuel injection similar to the Atlasco system of the Atlas-Imperial Diesel Engine Company of Oakland, Calif., was developed in Italy under the name of the Caproni-Fuscaldo system and was described in these pages several years ago. This system was intended chiefly for aircraft engines operating on low-volatility fuels and requiring only low injection pressures. So far as is known, it has not gone into quantity production for this purpose, but the system has been applied in a more or less experimental way to a considerable number of engines ranging all the way from a single-cylinder motorcycle to a twelve-cylinder aircraft engine. One of the aircraft engines fitted with it was the Piaggio radial of 1180 cu in. displacement, which passed its bench tests in 1939 and its flight tests in 1940. With the fuel injection system it is said to have shown a slight increase in power and a very substantial decrease in fuel consumption, amounting to 17.4 per cent at 2150 rpm, 23 per cent at 1800 rpm, and 27 per cent at 1600 rpm.

Many of the engines on which this system has been installed employ ethyl alcohol or alcohol mixtures as fuels. A light delivery truck with an engine of 30.5 cu in. displacement is equipped with four fuel tanks containing, respectively, ethyl alcohol, and mixtures of alcohol with peanut oil, palm oil and castor oil. A four-way valve permits of connecting either of these tanks to the fuel injection system, and the engine change-over from one fuel to another is said to take place without causing an interruption in the power flow. An Alfa Romeo 152.5-cu in. racing car fitted with this injection system and using a fuel consisting of a mixture of ethyl alcohol and palm oil took part in the 1940 1000-mile race for the Brescia Grand Prize and finished fifth. The engine was said to have operated perfectly throughout the race. At the conclusion of the race it was placed on a dynamometer and was found to peak at 5500 rpm, as compared with 4800 rpm when equipped with a carburetor.

Three advantages over the conventional carburetor are claimed for this injection system, as follows: (1) Increase in power due to equal distribution of the fuel—since the charge delivered to each cylinder can be adjusted separately—and to an increase in the volumetric efficiency, since the wire-drawing of the carburetor throat is eliminated; (2) increase in the economy of operation, and (3) greater freedom from fire hazards, as there is no possibility of backfiring through the carburetor.



**"AEROSCREW"**



### THREADED TAPER PINS

High-strength nickel steel taper pins, generally used in aircraft construction. Used with special washer (see below) and a thin slotted or self-locking nut. Ordinarily furnished drilled with cotter pin hole. Made of WD2330 nickel steel in accordance with Army-Navy Specification AN-QQ-S-629. Centerless ground after hardening, and cadmium plated.



### TAPER PIN WASHERS

Ordinarily, these are a screw machine product, but ours are stamped. Thus we are able to provide accurate, uniform washers with prompt delivery and at lower cost. Compare our prices! Made from high quality steel and cadmium plated to Army-Navy Specification AN-QQ-P-421. Sizes to fit all popular taper pins in stock. Four weeks delivery on sizes not in stock.

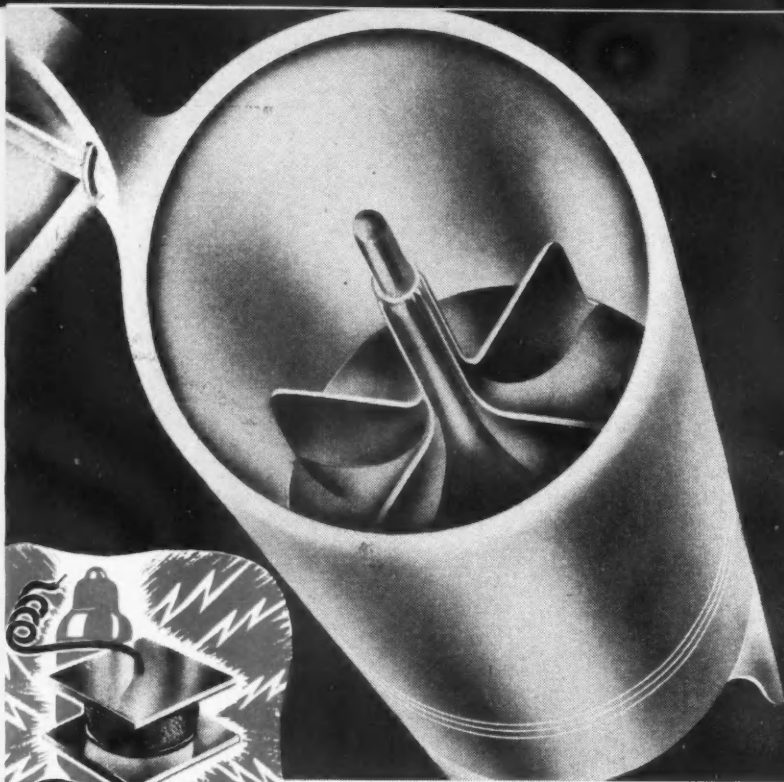
*We are Specialists . . .*

in the manufacture of selected items of aircraft hardware. In addition to the above, we can furnish high-quality Drilled Head Aircraft Bolts, Drilled Fillister Head Machine Screws, Hexagon Head Bolts, Clevis Bolts and Pins, Washer Head Screws and Precision Studs.

*Write for Catalog and Engineering Data*

**AERO SCREW COMPANY**

19th Ave. at 12th St., Rockford, Illinois

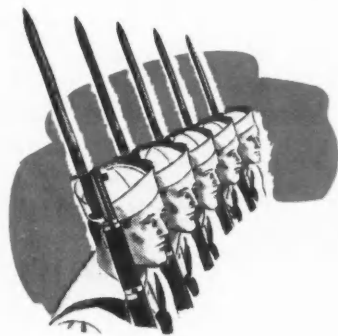


## Rapid Fabrication of Large Parts

Molding has always been one of the fastest and most economical methods of producing plastic parts in quantities. But through a recent development of Bakelite Laboratories—Heatronic Molding—the technique of molding has been accelerated still further. Heatronic Molding employs electrostatic heating of thermosetting materials, so that heat is generated uniformly within the charge of molding material by high-frequency current. Curing time can be reduced 10 to 50 per cent, and molding pressures lowered by 30 to 40 per cent. Large-sized parts never before possible can now be produced on standard presses. For the first time, the compression molding of pieces thicker than  $\frac{3}{8}$  inch from thermosetting materials becomes commercially practicable. And, now, the impact-type phenolic plastics can be molded as readily as the general-purpose phenolics.

Manufacturers will immediately recognize the opportunities this process offers in the production of such large equipment as washing machines. The entire tub-and-gear housing could be completely formed as one unit, in a single operation, using the same sturdy and water-resistant plastic adopted for washing machine agitators. It would be strong and durable, yet light in weight. It would have highly desirable heat-insulating characteristics, and would be inert to caustic solutions.

# Why



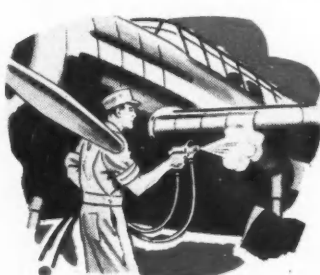
## TOUGHNESS for thin sections...

The development of plastic bayonets for Navy training purposes demonstrates the high tensile strength and flexural strength obtainable even for thin-walled parts when they are molded from BAKELITE Molding Board Materials. These impact-resistant plastics are supplied in sheets of various sizes, or in shapes cut to the approximate design of the finished parts. The blanks, as they are then called, are virtually preforms, which can be used in molds designed for general-purpose phenolics. Products can be made entirely from these materials, or the molding boards and blanks can be used with standard types of phenolic plastics to provide reinforcement at vital points.



## LOW-COST metal replacement...

By adapting the plastic printing plate development of Bakelite Laboratories to the production of instrument control panels, one manufacturer is conserving impressive quantities of precious sheet aluminum and even more precious man-hours. A matrix of BAKELITE Phenolic Material is made from an etched copper plate, which serves as the original pattern. Any number of VINYLITE Plastic panels can be molded in this matrix, complete in every detail, and ready for subsequent curving to final shape by heat treatment. The combined use of these two materials assures faithful reproduction in one operation of not only the intaglio lettering, but also the hundreds of through-holes in the panel. It eliminates many operations necessary with metal plates, such as drilling, engraving, slotting, forming, anodizing, and polishing. (Panels molded by Theo. Moss & Co., Inc.)



## DURABLE coatings that dry in minutes...

By the addition of BAKELITE Dispersion Resins to paint and varnish formulations, drying time can be reduced from hours to minutes. Such coatings, used by the Navy for more than 8 years as anti-corrosive aircraft primers, air-dry in 1 to 5 minutes without blistering or wrinkling, but nevertheless exhibit remarkable durability. Primers based on these resins and exposed, without top coat, for  $2\frac{1}{2}$  years on steel panels, revealed no checking or rusting. They have withstood 1,080 hours in a 3 per cent salt solution spray test, while other high-quality primers failed in 90 hours. They have shown no blistering, pimpling, or rusting after 8,000 hours of continuous immersion, whereas other primers failed in 300 hours.

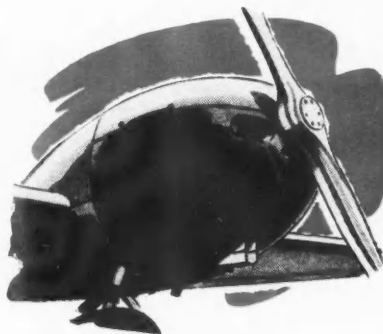


## Helpful Literature on Plastics

These are a few of the valuable guidebooks you can obtain by writing to Department 27. "A Simplified Guide to Bakelite Plastics" is a 16-page summary of the principal BAKELITE Plastics now available. It describes each type briefly, and illustrates typical applications. "Bakelite Molding Plastics," a 32-page booklet, provides further information, and ASTM data, on moldable plastics. "Molding Technic for Bakelite and Vinylite Plastics," price \$3.50 postpaid, is a 224-page manual on the art of molding plastics—contains comprehensive data that the designer, engineer, molder, and user should have on the design and fabrication of hot-set and cold-set molding materials. Additional pamphlets and booklets describing other types of BAKELITE Plastics are also available.

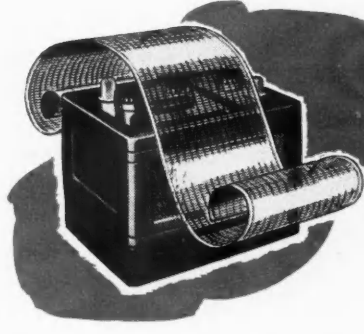


# Plastics ?



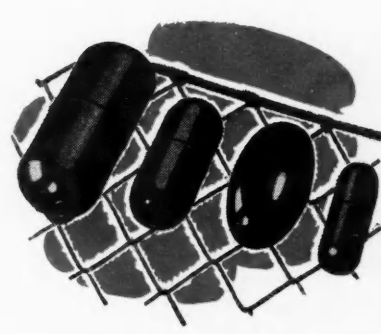
## Remarkable DURABILITY for wood ...

Stronger and lighter than metal, yet unaffected by extremes of heat or cold, oil, gasoline, and constant vibration, wood impregnated with BAKELITE Resins and molded into three-dimensional forms has become a most valuable structural material in the building of aircraft. Engine cowlings that resist high heat are representative of the many large shapes now molded from wood impregnated with BAKELITE Resin. Entire fuselages and wings can be formed. Sections as long as 84 feet have been successfully produced in torpedo boat construction.



## Unusual water RESISTANCE and strength...

Because they are tough and flexible enough to withstand pressures encountered at underwater levels as deep as 1,000 feet, BAKELITE Polystyrene floats are able to release for other service the galvanized steel sheets formerly used to buoy commercial fishing nets at sea. The polystyrene material is extremely resistant to constant immersion in salt water, and also withstands the chemical solution used in cleaning and renovating the nets.



## RESISTANCE to corrosive chemicals ...

BAKELITE Polystyrene Plastics, in the form of flexible sheeting, are now employed as storage battery separators. Like all other forms of this amazing plastic—molding materials, extruded rods, tubes, and filaments, and resins for surface coatings—the flexible film is unexcelled in its resistance to both alkalies and non-oxidizing acids. Other outstanding advantages of BAKELITE Polystyrene Plastics include: extreme lightness in weight with good mechanical strength characteristics, superior electrical insulating qualities particularly at high frequencies, and high index of refraction when crystal-clear types are employed.

**H**ARDLY A DAY PASSES but another new industrial development is made possible through plastics, or the usefulness of old, familiar products is increased by these versatile materials. Look for the reason and you'll find that the trend to plastics is much more than a matter of replacing other materials. It's because plastics frequently provide a better product, and generally one that is also more rapidly and economically fabricated.

Certain BAKELITE Molding Materials, for example, can give your products high mechanical strength approaching metals—with only a fraction of the weight of metal, and no need for time-consuming finishing. They can provide inherent corrosion resistance, electrical properties, heat resistance, color, transparency, translucency, or opacity. And a new molding technique now permits large parts to be molded at high speeds and in greatly increased sizes never possible before.

Wood becomes a stable and amazingly strong material when bonded or impregnated with BAKELITE Resins ... releases steel in building construction ... can be molded into heat-resistant and weather-resistant forms of varied shapes and sizes. Surface finishes fortified with one type of BAKELITE Resins dry within a minute or so, yet stand up in service far longer than many other high quality coatings that require hours to dry.

But these are only a few of the plastics developments now available to industry, and merely a suggestion of the vast opportunities they offer to designers and engineers. You can keep posted on plastics by keeping in touch with Bakelite Plastics Headquarters. Our Engineering Staff and Development Laboratories offer their full co-operation in helping you adapt a growing variety of plastics and resins to your essential needs. As a first step, write for the helpful literature shown here. Please address Department 27.

BAKELITE CORPORATION, 30 E. 42ND ST., NEW YORK  
Unit of Union Carbide and Carbon Corporation

UCC

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The word "Bakelite" and the identifying products



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## PLASTICS HEADQUARTERS

## War Production of Automotive Industry

(Continued from page 48)

ing gear is connected to the rudder, permitting conventional steering of the vehicle in the water. The "duck" is not a combat vehicle but intended to help in landing operations, cross rivers or marshes and unload cargo vessels. The first unit was under test 38 days after receipt of the letter of intent.

Although total munitions production in May advanced 2 per cent over April, equipment for the Army Ground Forces

dropped  $3\frac{1}{2}$  per cent and was  $5\frac{1}{2}$  per cent below actual needs. The latter comprises about one-sixth of total war output. Production for the Army Service Forces was 6.7 per cent below May schedules, according to Lieut. - Gen. Brehon Somervell.

Aircraft output in May was more favorable, with a record total of 7,200 planes produced. This was 1,000 more than the March total. Sixty-eight per cent of the May total was bombers and fighters, according to Robert Patterson, undersecretary of war, who said monthly production at the Ford Willow Run plant is now in three figures and "really rolling." At \$3,300,000 increase

in the DPC contract with Ford in order to triple the hangar space at Willow Run has been approved. This brings the total Willow Run commitment to \$82,600,000. Greater efficiency in production of the B-24 bombers has boosted output. An automatic spar riveter which drives 1,300 rivets in 37 minutes with three operators has replaced an operation which required 150 minutes and five employees. Time for completing a spar for the center wing section has been reduced from 116 to 24 man-hours in eight months. Man-hours required to build the 55-foot center wing section have been reduced 92.6 per cent in eight months. Skin and stringers are joined together on separate fixtures before being taken directly by crane to the fixture holding the center wing assembly. This has resulted in a 62 per cent decrease in man-hours. A new multiple head drill now bores 716 holes in a skin splice automatically in eight minutes with one operator. This replaces a manual operation that took 45 minutes for two operators.

Norge Division of Borg-Warner Corp. has entered the production program for Sikorsky helicopters at a Detroit plant. It will make the main rotor transmission, with power take-off, to drive the torque compensating rotor at the rear of the fuselage. Nash Kelvinator Corp. already has contracted to make these helicopters for the Army under license from United Aircraft Corp.

Fisher Body Division of GM has increased its commitments for the Navy with receipt of a letter of intent to produce 5-inch dual purpose gun mounts. The work will be distributed among four Fisher Body plants in Michigan. This high precision work requires that all welded sections be inspected 100 per cent by magnaflux. Average inspection time for a complete mount is three weeks. All welders on this work must pass a thorough Navy examination before qualifying for the job. The first mount will be delivered in the fall.

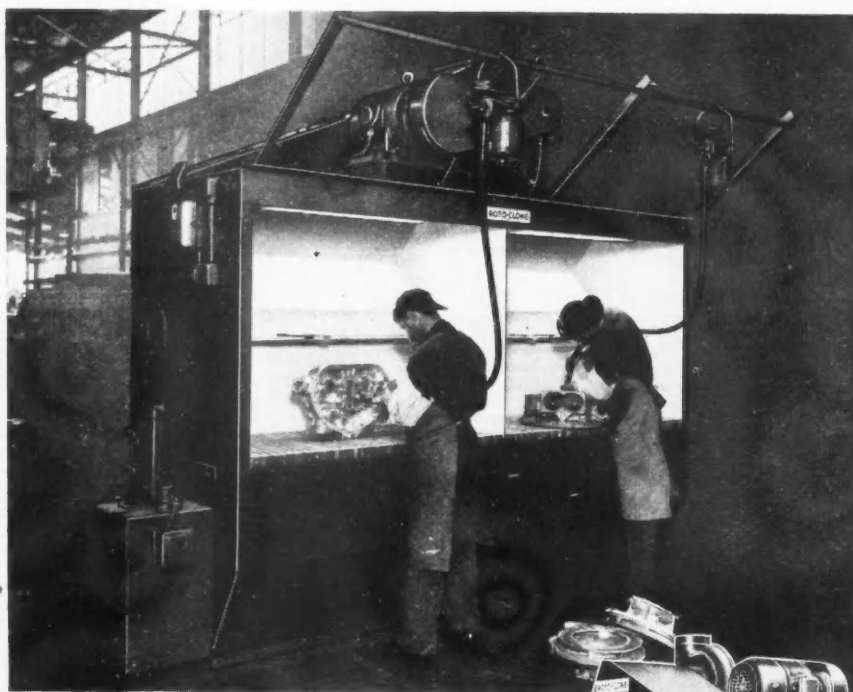
The \$71,510,438,873 War Dept. supply bill for fiscal 1943-44 contains more than \$50,000,000,000 for aircraft, including purchase of 99,740 planes. This huge air fleet will comprise 36,000 bombers, 38,000 fighters, 12,000 transport planes, 9,000 trainers and the rest miscellaneous. Maintenance of 900 airfields is provided.

## Koroseal Used in Chrome Plating

Koroseal, the plasticized polyvinyl chloride developed and sold exclusively by The B. F. Goodrich Company has found another wartime use.

A large New York company which utilizes a special process for chrome hardening surfaces of engine cylinders, gun barrels and other products is using Koroseal sheet as the best insulator yet found for use in plating these.

A pilot plant where other concerns are being instructed on the process is now in operation.



## Safe MAGNESIUM DUST Control

One of the hazards in working with magnesium comes from the magnesium dust created by grinders, buffers, polishers, etc. To meet all requirements for the safe handling of this dust, AAF engineers have developed the Type N Roto-Clone, which is available in the form of Benches and Units in various sizes and capacities.

Distinguishing features of the Type N Roto-Clone are the elimination of all restrictions, ledges or recesses where damp magnesium dust could be deposited, and the precipitation of dust under liquid, one of the proven safe methods of storing this material.

If you have a magnesium dust problem write for Roto-Clone Bulletin No. 277, which will be sent without obligation.



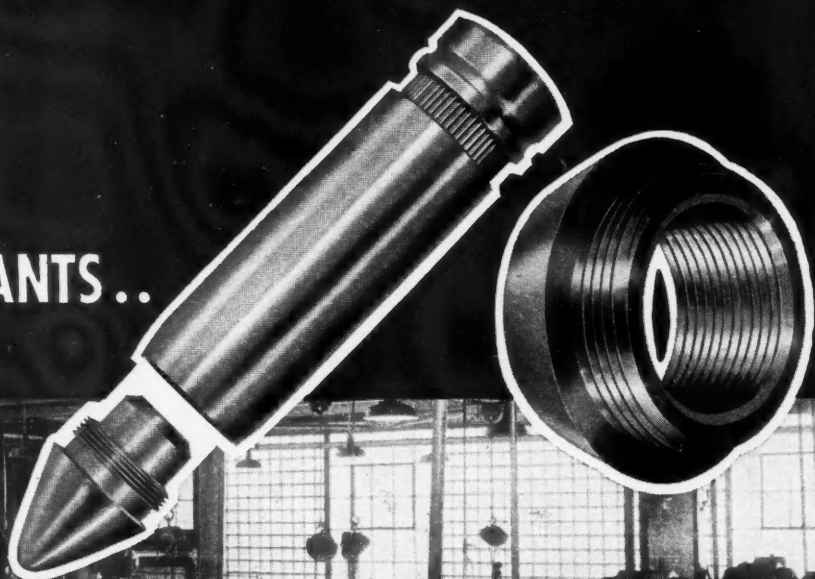
Unit type Roto-Clones in large or small capacities for serving individual installations of magnesium grinding stands or central exhaust from a number of dust sources are available.



AMERICAN AIR FILTER COMPANY, INC., 449 CENTRAL AVE., LOUISVILLE, KY.

INCORPORATED IN CANADA, DARLING BROTHERS, LIMITED, MONTREAL, P. Q.

IN AMERICA'S  
GREAT PRODUCTION PLANTS..



In the great plants of the Link  
Belt Company, batteries of Acme-  
Gridley Automatics turn out  
endless streams of precision parts  
for Ordnance and Ammunition.

# Better ammunition-QUICKER!

IT IS AN UNCENSORED FACT that our armed forces pack more fire power than the enemy, and use it more effectively.

Acme-Gridley Automatics are helping to produce the better guns and better ammunition that point the way to Victory through superior marksmanship and "more hits."

These modern automatic machines main-

tain accuracy at high speeds. They produce faster. They often combine many intricate operations into one—to save time and reduce costs.

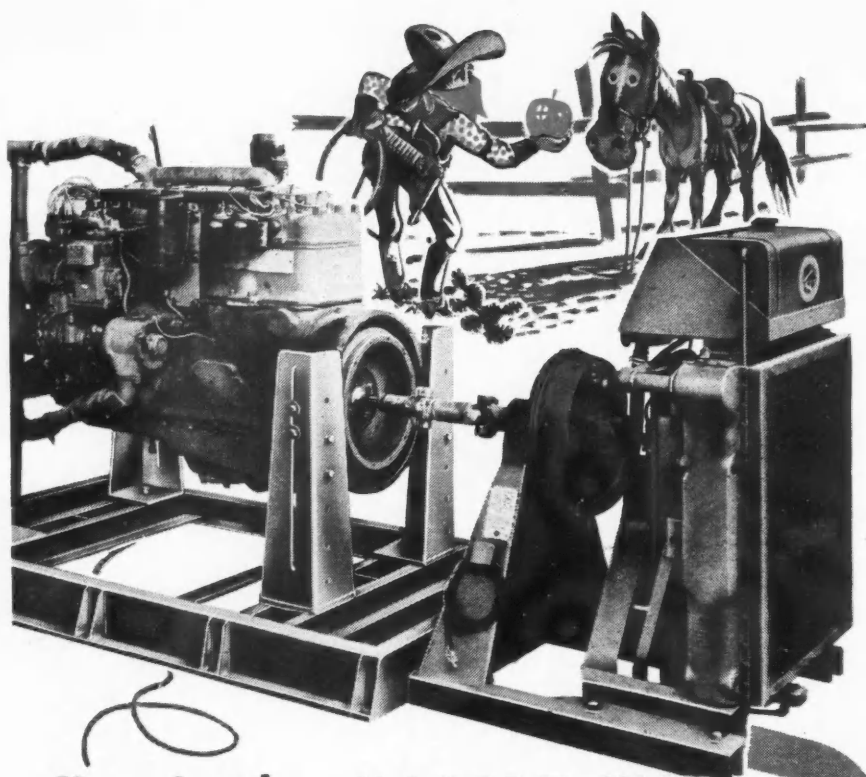
The effective production work of Acme-Gridleys will be equally effective in turning out—at new low costs—the improved goods on which peacetime prosperity must be based.

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ACME GRIDLEY 4-6 AND 8 SPINDLE BAR AND CHUCKING AUTOMATICS • SINGLE SPINDLE AUTOMATICS • AUTOMATIC THREADING DIES AND TAPS • THE CHRONOLOG • LIMIT AND CONTROL STATION SWITCHES • SOLENOIDS • CENTRIFUGES • CONTRACT MANUFACTURING





## Here's the MODERN WAY to CATCH HORSE THIEVES

With human life often dependent on motor performance, our Army is taking no chances on the condition of new, overhauled or rebuilt engines.

Before a replacement engine is installed in a motor vehicle, it must *prove* its condition by pulling loads which closely simulate actual operating conditions.

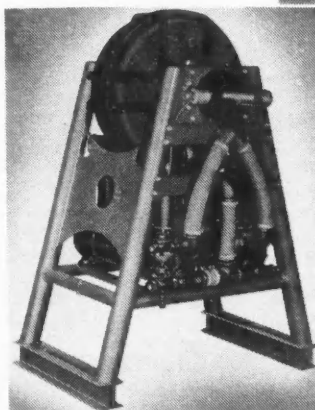
The Clayton dynamometer unit, illustrated above, provides these varying loads and measures the power output of the engine throughout its entire performance range. This procedure *guarantees* tip top mechanical condition, with every possible "thief of power" captured and eliminated!

Like all Clayton dynamometers, this engine test unit is simple, accurate and produced from a minimum of critical materials. Specially developed for overseas use, it is completely self-contained. No electric current or water supply is required for cooling either power absorption unit or test engine.

Clayton dynamometers of another type are testing new, giant aviation and marine engines. "Laboratory" accurate, they cost less and require a minimum of technical skill for operation and upkeep.

Models from 50 to 4000 H.P. for laboratory use or production testing.

● Other Clayton Products serving the Armed Forces are Kerrick Kleaners... Kerrick Cleaning Compounds... Clayton Steam Generators... Clayton Boring Bars and Bar Holders, and Clayton Hydraulic Liquid Control Valves.



Clayton 2400 Horse Power Engine Dynamometer, controlled by a flick of the finger, requiring only 29½x45-inch floor space. Weight 1875 lbs.

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## Conservation of Tungsten in Automotive Electrical Parts

A committee formed by the S.A.E. War Engineering Board, at the request of R. L. Vaniman, Director, Automotive Division, War Production Board, has recommended steps to reduce the amount of tungsten required for contact points of automotive replacement parts for civilian use. The committee points out, however, that the life of contact points will be shortened, and more frequent adjustments required, if these recommendations are adopted.

The critical condition now existing in tungsten is said to be caused by a lack of facilities for fabricating the tungsten stock used by the electrical equipment manufacturers, and not by a shortage of tungsten ore. The shortage is due, it is understood, to the greatly increased demand for tungsten in such vital military uses as radio equipment and high speed tools. The committee made the following recommendations:

About 40 per cent of the amount of tungsten required for distributor points can be saved by reducing the diameter and thickness of the points. Points with a diameter of .150 in. and thickness of .040 in. can be reduced to .125 in. diameter and .030 in. thickness, while points of .187 in. diameter can be reduced to .150 in. These changes can be made quickly without requiring any appreciable amount of new equipment. Although the above reduction in the size of points will result in more frequent adjustments, the committee did not feel that this would be too serious under war-time driving restrictions.

The committee agreed that platinum-iridium can be used as a substitute for tungsten in distributor points. However, the cost of platinum-iridium is approximately 56 times greater than that of tungsten, which would make the material questionable for a civilian replacement item. Also, it is known that platinum-iridium is highly critical because of its aircraft engine use.

Molybdenum is usable, although its life, as well as the life of platinum-iridium, would be only about one-tenth that of tungsten, and the material would have to be fabricated on the same inadequate facilities that are now used for tungsten stock.

In the opinion of the committee, a great deal of tungsten can be saved for other uses by requiring every purchaser of new distributor points to surrender the old ones. It is believed that approximately 60 per cent of these salvaged points can be redressed and used again. In many cases, points can be redressed and used more than once.

Most voltage regulator points are not now made from tungsten. Only one manufacturer uses tungsten for one of the contact points, and the thickness is only .020 in.

No new stock of horn contact points has been furnished to horn manufacturers for quite a while. New requirements will come out of present stock.



# AIR SUPREMACY

AT HIGH AND  
LOW PRESSURES

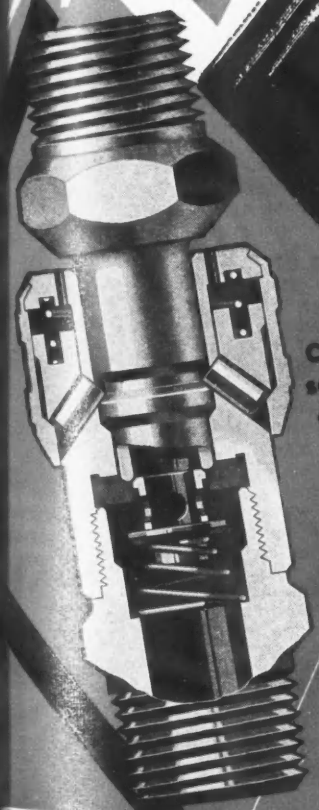
## HANSEN

AIR HOSE COUPLINGS

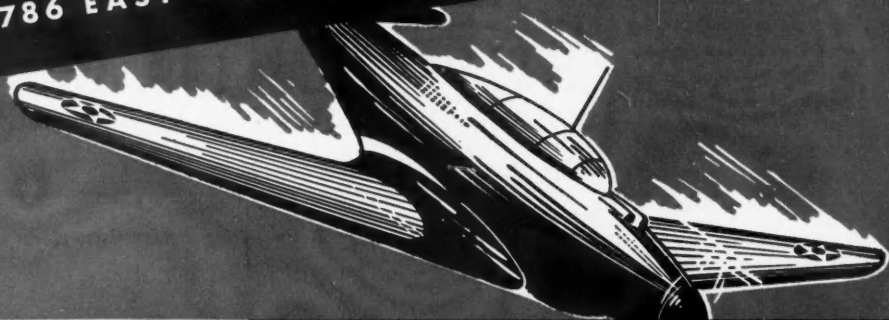
Regardless of whether it's high or low pressure, Hansen **PUSH-TITE** air hose couplings are masters of the air. Air costs money and leaks are too expensive to be ignored, regardless of how big or little they may be.

Hansen Couplings will handle an extreme wide range of pressures, anything from 1 ounce, skyrocketing up to over 14000 pounds without leaking, and that means an "air savings" of considerable volume. But there is much more to a Hansen **PUSH-TITE** coupling than "air savings," for instance, they are much easier and faster to operate... a slight push of plug into socket, connection is made and air is automatically turned on. To disconnect, merely use a little thumb pressure on sleeve, plug is ejected, coupling is disconnected and air is automatically turned off. Nothing to turn, twist or lock. Nothing to bind, jam or stick. Full swivel action eliminates twisting or kinking of hose. Hansen **PUSH-TITE** couplings more than pay for themselves in speed, increased production, air savings and efficiency... send for new free catalog.

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Cutaway  
section of  
coupling





## Producers Favor Stockpiling Bill

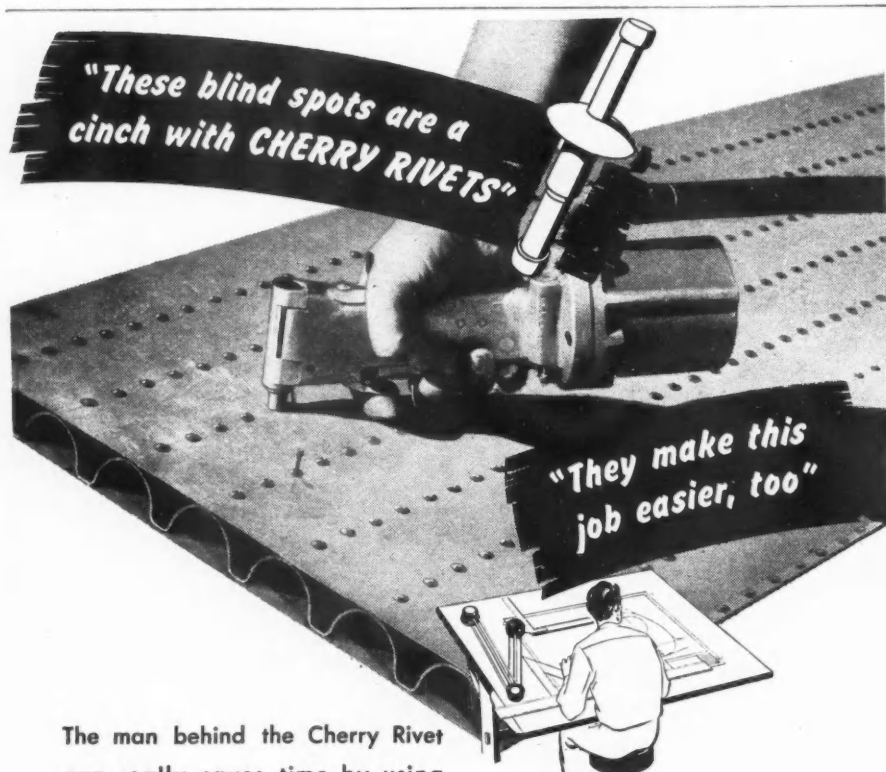
(Continued from page 48)

from the June coal mine strike, are being offset to some extent by the WPB drive to obtain an extra 2,000,000 tons of steel in the second half of this year. Cooperation by representative steel users in the WPB "Share the Steel" campaign, aiming at elimination from producers' order books of every ton of steel which isn't absolutely needed for the carrying out of 1943 contract obli-

gations, is proving helpful in this effort. For all that, it is feared that the dent made in the coke supply by the coal miners' strike will hold down pig iron output for some time to come. Further light on the operation of CMP is expected to be shed when examiners, who have been investigating the actual operation of the plan in fabricators' establishments, report their findings in the course of the next few weeks. Large consumers are reported to have little difficulty in complying with CMP requirements, but say WPB officials, many smaller concerns still fail to place allotment numbers on their orders for controlled materials. Alloy tubing,

hot rolled sheets and plate lead in the steel demand, with the capacity of some of the producers of these items fully booked over the remainder of the year.

Opening of a new unit for the production of magnesium and progress in the consideration by WPB of suitable sites for the erection of an additional aluminum reduction plant reflect the continuing importance of these light metals in the war program, especially so in aircraft construction, where the contemplated increase in the building of heavy bombers makes additional supplies imperative.



The man behind the Cherry Rivet gun really saves time by using Cherry Rivets wherever it would be difficult to use a bucking bar. And he turns out a better job . . . thanks to the positive mechanical action which is an important feature of the Cherry Rivet.

To the engineer these rivets mean even greater advantages. He can now design up to efficiency rather than down to a manufacturing limitation. The high shear and fatigue values and the excellent shank expansion of Cherry Rivets eliminate the necessity of designing away from blind spots in both primary and secondary structures.

CHERRY RIVETS. THEIR MANUFACTURE AND APPLICATION ARE COVERED BY U. S. PATENTS ISSUED AND PENDING.



Get the complete story on Cherry Rivets. Sizes, styles of rivets, application techniques and riveting tools are fully described in the Handbook A-43. Request your copy from Dept. A-109, Cherry Rivet Co., Los Angeles, California.

**Cherry Rivet**  
Company  
LOS ANGELES, CALIFORNIA

## BOOKS . . .

1943 A.S.T.M. SYMPOSIUM ON RADIOGRAPHY. This 265 page book issued by the American Society for Testing Materials includes 18 technical papers presented by outstanding authorities. The major part of the book includes the technical contributions in the 1942 Symposium, but an important part is the collection of 1936 papers, several of which have been extensively revised, some condensed. Issued through the work of a special group of A.S.T.M. Committee E-7 on Radiographic Testing, the Symposium has as its basic purpose the development of better understanding of radiographic tests and their significance on the part of both the consumers and producers of materials.

There are extensive contributions on principles of radiography; foundry applications; miscellaneous applications; gamma-ray radiography with instructions for using radium; and the problem of inspection. Other topics covered include applications to production problems; welds and weldments; magnesium castings; correlation of mechanical properties and radiographic appearance of magnesium alloy castings; million-volt portable unit; high-voltage X-rays in the boiler shop; welded high pressure power plant piping; apparatus used in radium radiography; exposure meter; study of cassette design; precision radiography; X-ray film evaluation; industrial X-ray protection; and recommended A.S.T.M. industrial radiographic terminology.

Special coated stock has been used to bring out the 175 illustrations used in the book. Copies of this publication in red cloth binding, 6 x 9 in. can be obtained from A.S.T.M. Headquarters, 260 S. Broad St., Philadelphia, Pa. at \$4.00 each.

PRINCIPLES OF IGNITION, by J. D. Morgan, D.Sc. Published by Sir Isaac Pitman & Sons, Ltd., London (Pitman Publishing Corporation, New York).

The subtitle of this book gives a good idea of its contents: "A description of the main facts and theories relating to the ignition of inflammable gas mixtures by sparks, flames, incandescent solids, and other sources." The first six chapters deal with facts relating to the ignition of gaseous mixtures which have been ascertained experimentally, while the remaining three are devoted to ignition theories. The author approaches the subject from the scientific rather than from the technical point of view, and there is nothing in the book on actual ignition equipment as used for internal combustion engines. It is a very readable volume, however, and should prove of interest to those engaged in the development of ignition equipment.



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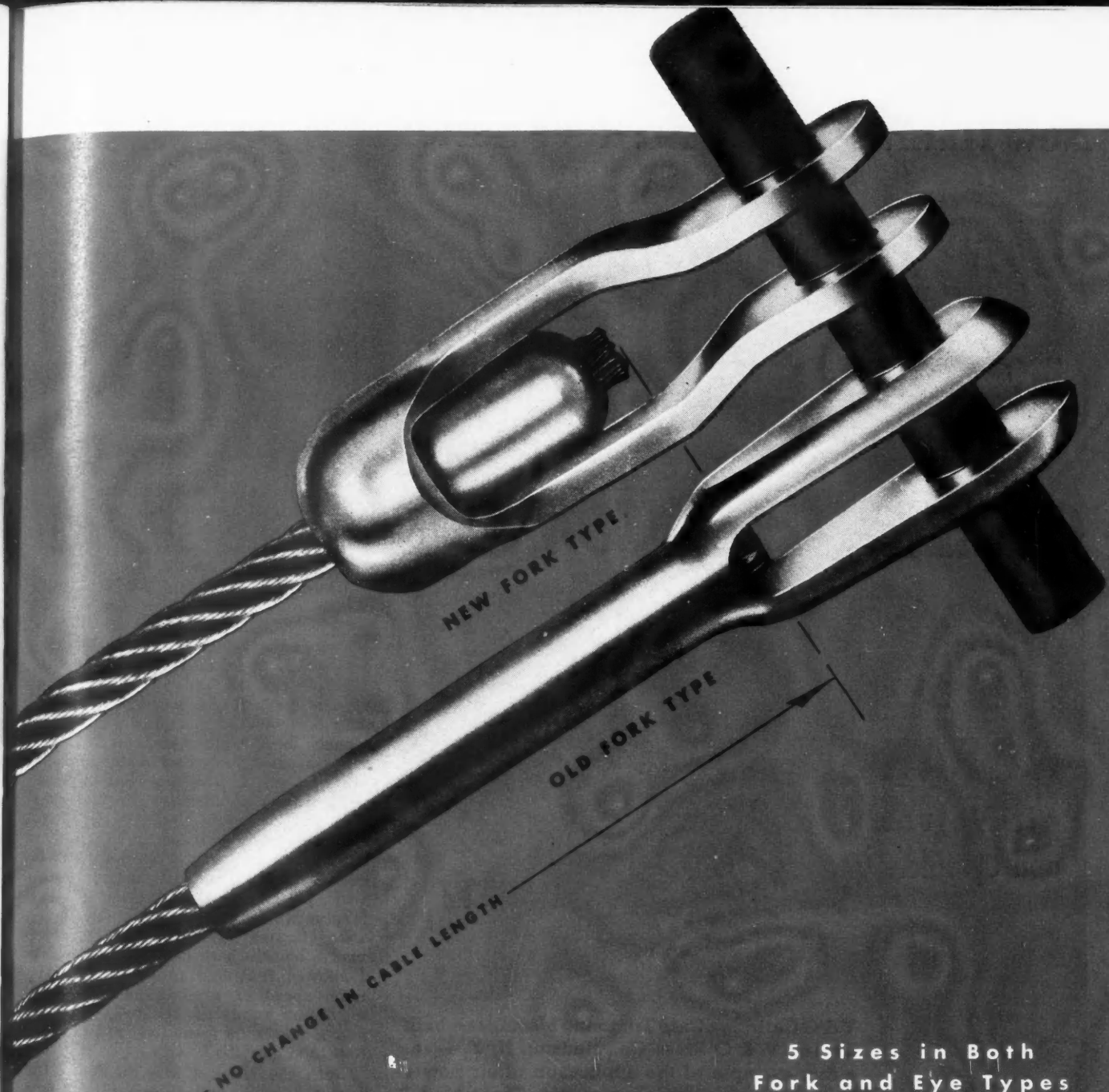
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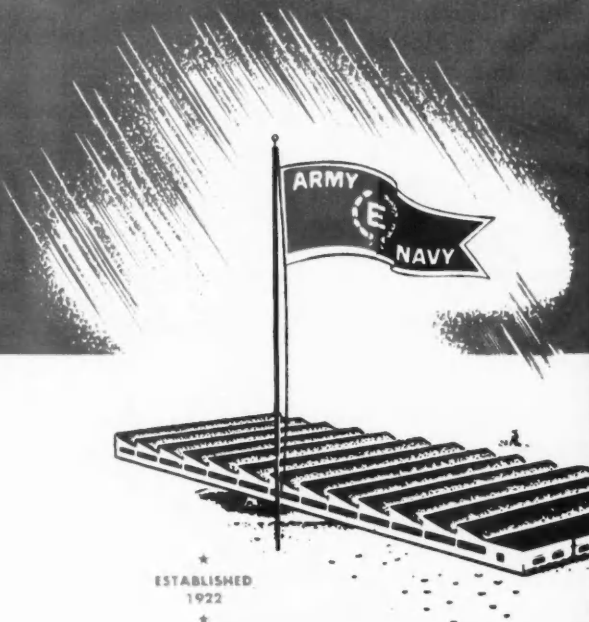
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5 Sizes in Both  
Fork and Eye Types

(1/16" · 3/32" · 1/8" · 5/32" · 3/16" Cable Sizes)

Suitable for other cable sizes and types  
Available on special order

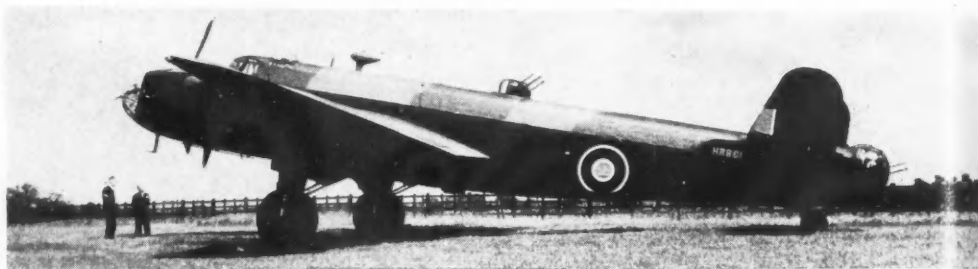


**POULSEN  
&  
NARDON,  
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LOS ANGELES 11 \* CALIFORNIA

# New Halifax Heavy Bomber Series

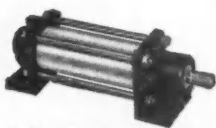
New type of Halifax four-engined bomber. The front turret is displaced by a Perspex nose with a central hand-operated machine gun. A four-gun Boulton and Paul dorsal turret is fitted in place of the Hudson type two-gun turret. The tail wheel is now semi-retractable.



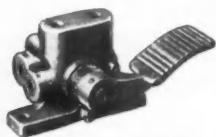
## COMPLETELY AUTOMATIC

Thanks  
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Air Valves  
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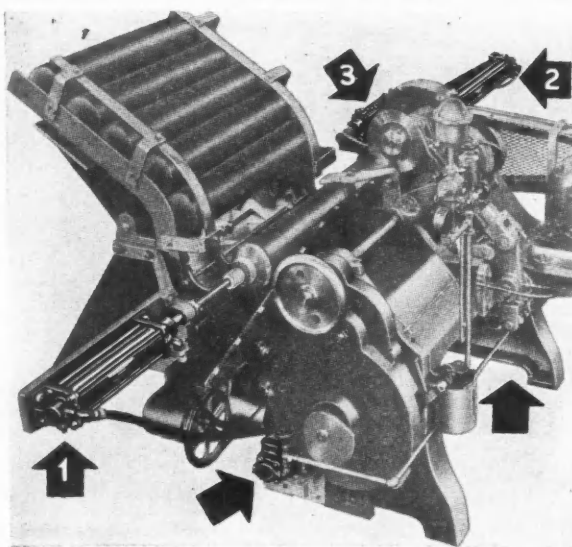
Arrows above  
indicate loca-  
tion of NOPAK  
Air Cylinders  
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Valves.



3 Model "A" Air Cylinders, in varying strokes and sizes, are used on each V & O Trimmer.



3 Model "R" Foot Valves, adapted to cam operation, actuate each cylinder.



**V & O Cartridge Case Trimming Machines**—built by The V & O Press Co., Hudson, N. Y. — are a fine example of the application of air power to precision machine movements. Three Model "A" Air Cylinders are used on each machine: —One for gauging and trimming, the second for ejecting the trimmed cases, and the third for stripping scrap metal from the trimming chuck. Each cylinder is controlled by a Model "R" NOPAK Foot-Type Valve actuated by cams accurately synchronized to maintain production at 18 cases per minute.

Inquiries are invited from machine designers, tool engineers and production managers who may be able to use similar applications of air or fluid power to master specific problems of design or production.

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# **NOPAK**

DESIGNED for AIR or HYDRAULIC SERVICE

**A** NEW series of the Halifax heavy bomber—one of the three types of British four-engined aircraft that have made so many and such devastating raids on the Ruhr and other parts of Germany—is now in full production and operation.

Known as the Halifax Mark II, Series Ia, it embodies many structural and aerodynamical improvements, which have resulted in considerable betterment in performance. The "cleaning-up" and the adoption of a new type of Rolls Royce engine, the Merlin 22, superseding the Merlin 20 previously used, have given this Handley Page product increased maximum and cruising speeds (10 per cent increase is mentioned unofficially), an increased rate of climb and, as an alternative to the higher cruising speed, greater operational range. Additionally, it is capable of carrying still heavier loads, with provision for disposing of the largest (8,000 lb) bombs. Performance figures published more than twelve months back concerning Halifax I showed that this type had a maximum speed of around 300 m.p.h., a maximum range of about 3,000 miles and a maximum bomb load of 5½ long tons (12,320 lb).

Both the Mark I and the Mark II, Series I had (and those still in use retain) a power-operated turret forming the nose; this feature has been abandoned in the new series and its place is taken by a large and wholly transparent Perspex nose of better shape than the turret permitted from the aerodynamical standpoint. Head-on attack has been found to occur very rarely on operational flights and the front armament now consists solely of a hand-operated Vickers "K" .303 in. machine gun projecting through the center of the nose, available for the use of the bomb aimer.

Another major change is the removal of the Hudson type upper turret with its two .303 in. guns and the provision, instead, of a Boulton and Paul, Defiant type, power-operated turret with four .303 in. guns. The rear four-gun turret remains as hitherto.

Among other alterations are main bomb doors of larger size (to enclose the largest bombs fully) with a new type of sealing that ensures a really close fit when the doors are shut.



## A Letter from Guadalcanal...

In a recent letter from a lad at Guadalcanal to his former employer was voiced the greatest challenge of our time.

"What," he said, "am I, and all these fellows with me, going to do when this thing is over?" Is peace to bring with it the deadly spiral: men laid off and demobilized, hence less purchasing power, hence more plants closed down, hence more men laid off, hence — ?

We believe we've seen the answer right on the production lines and right in the post-war plans of American industry.

We've seen and consulted with hundreds of research men uncovering new secrets in metallurgy, synthetics, plastics, aeronautics — finding

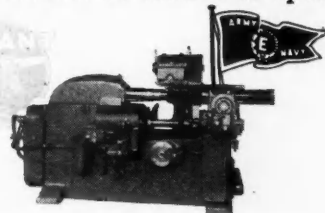
new techniques and economies — planning new and wonderful products that will cushion the post-war interim to the greatest production age in history.

As internal grinding specialists, we at Bryant have already helped to solve production problems involving the machining of many new light metals, alloys, and synthetic materials including glass, plastics, hard rubber, wood, graphite, and even machine parts made of paper.

We've developed many new techniques in tooling, and we believe that this knowledge is important to your future. For that reason, our Consulting Service is available at all times. Call upon us now!

# Bryant Chucking Grinder Company

Springfield, Vermont, U. S. A.



SEND FOR THE MAN FROM BRYANT...

July 15, 1943

When writing to advertisers please mention AUTOMOTIVE and AVIATION INDUSTRIES



## Assembly Line for the P-38's

(Continued from page 33)

lines are now being set up for several of the subassemblies of the airplane, and another mechanized line will carry the Lightning's two Allison engines to the point on the main line where they are attached to the airplane.

### Mechanical Operation of the Line

The actual operation of the main assembly line is of the most simple mechanical features obtainable with a minimum of working parts and simplicity of design for both operation

and maintenance. The first and third lines are operated by power units pulling the connected line, and the center or second line is operated by a unit pushing that line.

In actual operation the line moves forward until an electrical switch connection is made approximately 4 ft from the end of the line, at which time a warning bell is sounded, notifying the men involved that the ship is about in position for transfer to the adjacent line. The men assigned then discon-

nect utility lines, disconnect forward ship in line and manually push ship forward into transfer position and make the transfer. Immediately all lines and couplings are re-connected and the line continues in normal manner. Simultaneously with the disconnecting of the foremost ship in line comes the connecting of the new or added ship at the rearmost position of the line.

### Assembly Job Assignments

Stock racks lettered A, B, C, D, E, F, G, H, J and K run parallel to the moving lines, and each is divided into "top" and "bottom." Longitudinally each row is identified by foot marks corresponding to the painted markers along each side of the assembly line that indicate, in feet, the distance from the start of the line. The start of each of the three lines is indicated as "0," with the distance from this starting point indicated throughout the length of each line, progressing in the direction of travel of the ships. Numerals are placed each 5 ft to facilitate speedy identification.

Stock kits are made up from feeder racks, which are in numerical order of part, and then are placed in the hold rack built under and above the stationary side work stands. Left and right hand kits are placed accordingly.

There are no stationized work areas, but group leaders are given assignment sheets with personnel requirements, kits required and the starting point designated by a coordinate point in reference to the main beam of the ship. If a workman's job is scheduled to start, let us assume, at the 36-ft mark (which will be referred to as F/M 36) it means that when the main beam of the ship passes that point this workman will start his job regardless of the foot mark of his own work area. One person could be on empennage, another on nose and still others on beams but all on that particular ship would start, if they were scheduled to start simultaneously, when the main beam of the ship reached F/M 36. The assignment sheet also shows a finish point, which means that when the main beam passes that point the job should be complete.

Many kits formerly used have been broken up into smaller units to make possible the use of the kits now established on the increased schedules, without the serious problem of continuously changing kit, jobs and assignments. In general the individual jobs have been confined to the work which could be done within the passing of one ship if the line were to be run at the highest expected schedule with present man assignments consisting of a combination of such jobs.

It was recognized at once that this would mean that some operators would be working on several small jobs instead of one long job with remainders of the broken up jobs being carried over into the next stations. This will

(Turn to page 85, please)

## ARROW MIRRORS

*on Jeeps*



America's 1943 "army mule" is built for sturdiness, speed and maneuverability . . . no unessential equipment burdens or wastes space on a jeep. However, U. S. Army specifications require a rear vision mirror . . . ARROW is proud to add still another Arrow Safety Device to the tools of America at war. Practical designing and careful workmanship assure ARROW of long-lasting dependable service. Ask your jobber or write direct to Dept. 202.



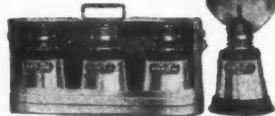
STOP LIGHTS



TURN SIGNALS



MARKER LIGHTS



OIL & ELECTRIC FLARES

**ARROW SAFETY DEVICE CO.**

GENERAL OFFICES: MT. HOLLY, N. J. • PLANTS IN MT. HOLLY and MEDFORD, N. J.

(Continued from page 82)

be done only so long as the schedule is low enough to warrant doubling up of jobs. As the schedule increases to the point where the present assignments cannot be carried out, the assignments will then be adjusted until maximum schedule is reached; at which time many of the short jobs now done in combination with others will constitute an entire assignment.

Certain jobs, however, cannot easily be broken up to conform to this general rule. Consequently, on these special jobs, the crew, or man who starts the job, will ride the ship until the job is complete or until the end of his shift, whichever comes first. Duplicate crews take care of succeeding ships. At the end of a shift the next shift crews take over wherever the former crews may be, and carry the jobs on to completion. In all assignments, if the end of the shift comes before the assignment is completed, the incoming shift crew takes over the unfinished assignments and completes them, so that the regular cycle is not interrupted.

## Liberator Nose Section Production Increased

(Continued from page 35)

and the nose section passes down the final assembly line as one unit where all the installations made on the primary assembly lines are integrated.

Under this production sequence based on the "separation" idea, the construction of the nose section in its entirety is reduced to nine major operations. These are, briefly:

1. Fabrication of small basic parts on individual jigs.
  2. Assembly of the nose section shell in fixed bucks.
  3. Transfer of shell from bucks to disassembly station by overhead crane.
  4. Disassembly of the shell into six segments: Astrodome, top panel, forward gun turret top panel, bottom panel, two side panels, and flight deck.
  5. Clean up of all segments to drive such rivets and install such instrument brackets as were difficult of access in the fixed bucks. Side panels and bottom panels are run down a line for this work. The same operations are performed on the two top panels and the flight deck at fixed stations.
  6. Installation of instruments, controls and various wiring and tubing systems on primary assembly lines.
  7. Reassembly of nose section.
  8. Final assembly of nose section on an intermittently moving line on which all installations previously made are integrated.
  9. Painting of nose section prior to delivery to the final assembly line of the complete Liberator.
- The new system enabled one-third of the workers formerly engaged in this work to turn out 33 times more nose sections.

## Douglas Output Greatly Increased

Douglas Aircraft Co., Inc., announced that it has produced 13,096,000 pounds of cargo and combat planes during the month of May. The total is 150% greater than the company's production in May, 1942, and 698% above that for May, 1941.

F. W. Conant, Douglas vice-president in charge of manufacturing, said that the company's three California plants are now at peak production, and that the three eastern Douglas factories will reach peak production by midsum-

mer. He estimated that last month's production was more than 15% by pounds of the total American output.

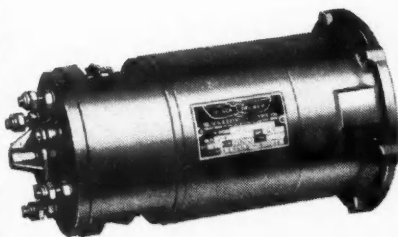
## Mack Making Parts for Republic Thunderbolt

Mack Trucks, Inc., has been producing high-precision high-strain parts for the Republic Thunderbolt, P-47, during the past year, according to an announcement made recently by company executives. This announcement revealed publicly for the first time the sub-contract work being performed by Mack in addition to its many prime contracts.

# 3 THINGS TO DO

IF YOU ARE PLANNING A *NEW* PRODUCT WHICH REQUIRES A  
*Special Application Motor*

- 1 Consider the suppliers with the most successful experience in the design and manufacture of special application (fractional horsepower) motors.
- 2 While the product is still in the early stages of development, select the company which in your judgment is best qualified to work with you in solving the problem.
- 3 Place your motor problem entirely in their hands or permit their engineering department to work with yours.



Many manufacturers have found that we fulfill all these important requirements both from the standpoint of engineering and production.

Write us about your problem and we shall be glad to send full information or arrange to have one of our representatives call.

**THE BLACK & DECKER ELECTRIC CO.**  
KENT, OHIO

# Black & Decker

FRACTIONAL HORSEPOWER  
SPECIAL APPLICATION **MOTORS**

# 10 Jobs You can do better with Explosive Rivets



- |   |   |                       |
|---|---|-----------------------|
| 1. Wing Tips                              | 4. Bomb Bay Doors                             | 7. Floor Construction |
| 2. Wing Skin Splices<br>over Corrugations | 5. Fairings                                   | 8. Cover Plates       |
| 3. Landing Gear Doors                     | 6. Attaching Miscellaneous<br>Inside Brackets | 9. Wing Flaps         |
|   |   | 10. Stabilizers       |

**MILLIONS** of Du Pont Explosive Rivets are being used in these applications to speed construction of many of America's outstanding airplanes.

Explosive Rivets provide the nearest thing to solid rivet performance of any blind rivet yet devised. Their one-piece solid shank gives strength where it is needed.

They're easy to set. Only one operation and only one tool required. You simply touch the rivet head with an electrically heated iron and in

from 1½ to 2½ seconds a tiny charge in the strong, solid shank securely sets the rivet in place. There are no secondary operations.

If you have a blind riveting problem . . . ask for details about this new, faster way of doing blind riveting. Call or write E. I. du Pont de Nemours & Co. (Inc.), Explosives Dept., 5494-G Nemours Bldg., Wilmington, Del.; 5-236-G General Motors Bldg., Detroit, Mich.; 5801-G South Broadway, Los Angeles, California.



## EXPLOSIVE RIVETS

THE ONE-PIECE BLIND FASTENER WITH A SOLID SHANK



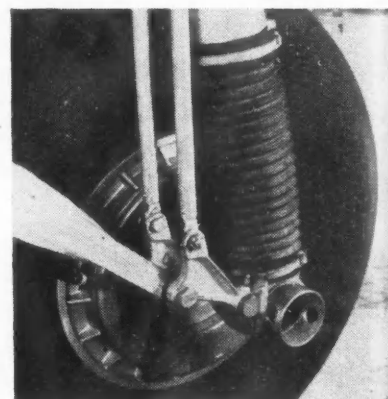
## New Products for Aircraft

(Continued from page 44)

Products, Inc., Elizabeth, N. J., is constructed of high conductivity copper and copper alloy. Electrical contact is made at the outside clip and at the inner plug, the latter being sealed-in to increase resistance to corrosion. The detent principle increases pull-out in pounds and resistance to loosening by vibration. No tools are necessary to connect or disconnect the bonding-jumper.

### Synthetic Rubber Protects Plane Parts

United States Rubber Company, New York, N. Y., has developed new synthetic rubber devices to protect airplane mechanisms which would otherwise be injured by dust or other foreign matter. Shown here is a dust excluder boot



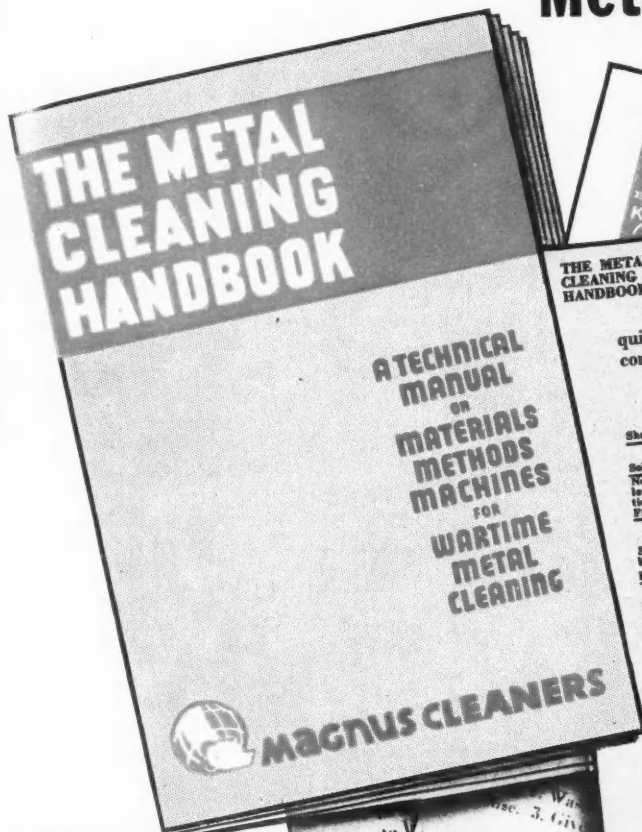
covering part of the landing gear equipment on a plane. The boot is made of lightweight fabric, coated with synthetic rubber. Because of the superior oil-resistant qualities of the synthetic rubber, it is not injured by contact with oil or grease.

### Instrument Panel Behind the Pilot

Patents for a novel installation of the instrument panel of military aircraft have been granted in Germany to the Henschel Co. and to the Arado Works. According to the abbreviated patent writs, the instrument panel in either case is no longer installed in front of the pilot, but behind him—or in the wing. The object is to prevent the pilot's attention from being distracted by the messages conveyed on the dials during dog-fights and other occasions demanding intense concentration. So that the pilot may read his instruments when necessary, both patents embody a kind of television set. In the Henschel patent, the image of one or several instruments is projected upon a screen in front of the pilot; in the Arado patent a reflection of the panel is projected on the windshield.



# The Only **COMPLETE** Manual on Metal Cleaning & Finishing



THE METAL  
CLEANING  
HANDBOOK

quite general. But they serve the purpose of breaking down a complex picture into one with some degree of simplicity.

**TABLE A — Small Parts**

Shape	Parts and units in this Class	Recommended Cleaner	Handling of the Parts	See Figure No.
Solid No hol- low por- tions Fragile	Threaded or machined parts — Bolts — Nuts — Screws — Washers — Rifle and machine gun parts — Ammunition — Bullet cores — Stamped and diecast units — Hardware.	Alkaline Cl. or Emulsifiable Agent	In bulk or in baskets On racks or in baskets	1-3-3a 5-10 4-5-11-12 10
	Unfinished small fire arms parts — Small cartridge cases and rough projections — Rough castings and stampings — Unfinished hardware and pipe fittings.	Alkaline Cl. or Solvent	In bulk In baskets	6-10-7-9 10
	Hollow or with deep recesses Fragile	Alkaline Cl. or Emulsifiable Agent	Individual On rack In baskets	3-8 4-5-12 10
Same but not Fragile	Hollow fine parts — Primer caps — Bullet jackets — Detonators — Small metal bases or containers — Gas masks parts — Deep drawn parts — Finished shell cases.	Alkaline Cl. or Emulsifiable Agent	Individual or in baskets	10
	Draws of shell and cartridge cases — Grenade cases — Elongated parts — Cylinders — Lamp cases — Searchlight parts — Moss hits — Valve and cock bodies — Fittings.	Alkaline Cl. or Emulsifiable Agent	Individual or in baskets	1-3-3a-3-b 6-10-7 10

**TABLE B — Medium Size Parts**

Solid No hol- low por- tions Fragile or not	Mechanical, motor engine parts (for airplanes — tanks — trucks — Household apparatus parts — Mudguards.	Alkaline Cl. or Emulsifiable Agent	In bulk Individual	1-3-3a 2-4-5-6
	Medium size shells and steel cases — Castings — Tubings — Deep drawings.	Alkaline Cl. or Emulsifiable Agent	Individual or in baskets	3-4-5-6-11-12 10
Hollow recessed Fragile	Same as above — Cylinders — Containers — Mine cases — Bomb bodies — Rough draws or castings.	Alkaline Cl. or Emulsifiable Agent	Individual or in baskets	3-4-5-1-2 10
	Same but not Fragile	Alkaline Cl. or Emulsifiable Agent	Individual or in baskets	10

**TABLE C — Large Parts**

Solid Fragile or not	Mechanical, automobile, chassis parts — Aircraft plates — Machine tool parts — Wheels — Frames.	Alkaline Cl. or Emulsifiable Agent	Individual	1-3-3a-4
	Milk cans — Drums — Large containers — Motor and pump bodies — Gun barrels.	Alkaline Cl. or Emulsifiable Agent	Individual	1-3-3a-10-10

**TABLE D — Large Bodies and Assembled Units**

All types	Auto, truck, airplane tank bodies — Tank armor plates — Gun bases and mounts — Turrets.	Alkaline Cl. or Emulsifiable Agent	Individual	14-16
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## ANSWERS TO YOUR FINISHING PROBLEMS

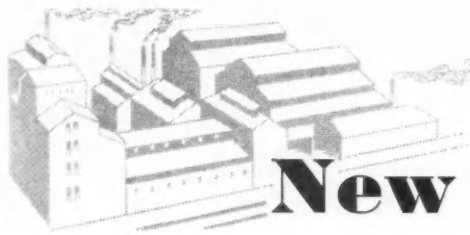
- Selecting Alkaline Cleaners
- Cleaning After Buffing & Polishing
- Cleaning Before Plating
- Selection of Washing Machine Types
- Degreasing Methods
- Cleaning After Drawing & Stamping
- Emulsifiable Solvent Cleaning
- Petroleum Spirits Cleaning
- Cleaning in the Repair Shop
- Machines for Pickling and Washing
- Electro-Cleaning Methods
- Machines for Burnishing & Cleaning

And hundreds of other answers on  
Metal Cleaning and Finishing  
Operations

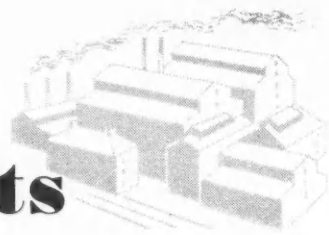
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Your Copy Now

**MAGNUS CHEMICAL CO.**  
196 SOUTH AVENUE GARWOOD, N. J.





## New Products



### New Hipersil Cores

Designed for a variety of applications in the communications field, such as, radio transformers, chokes, relays,

reactors and loading coils, a new line of type "C" Hipersil Cores is announced by Westinghouse Electric and Manufacturing Company, East Pittsburgh, Pa.

Available in a wide range of sizes, the new Hipersil steel cores are said to combine 1/3 more flux-carrying capacity with the same size and weight. The type "C" cores simplify assembly and replacement, since only 2 or 4 pieces are involved. Construction of the Hipersil core consists of winding the Hipersil strip continuously on a mandrel of desired dimensions. It is annealed at high temperature and vacuum impregnated with a plastic compound to make it a solid unit. It is then cut in two segments, the ends of which are machined and worked to produce coinciding surfaces when reassembled. A check test is made for fidelity of per-

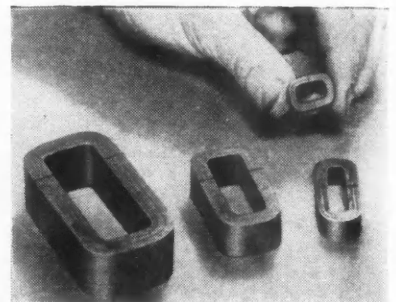
**LEADERSHIP**  
— the Reward of  
**ACHIEVEMENT!**

**BORG & BECK**  
*The Standard Clutch in Peace or War!*

For THAT VITAL SPOT  
where POWER TAKES HOLD  
OF THE LOAD!



**BORG & BECK DIVISION**  
BORG-WARNER CORPORATION  
CHICAGO, ILLINOIS



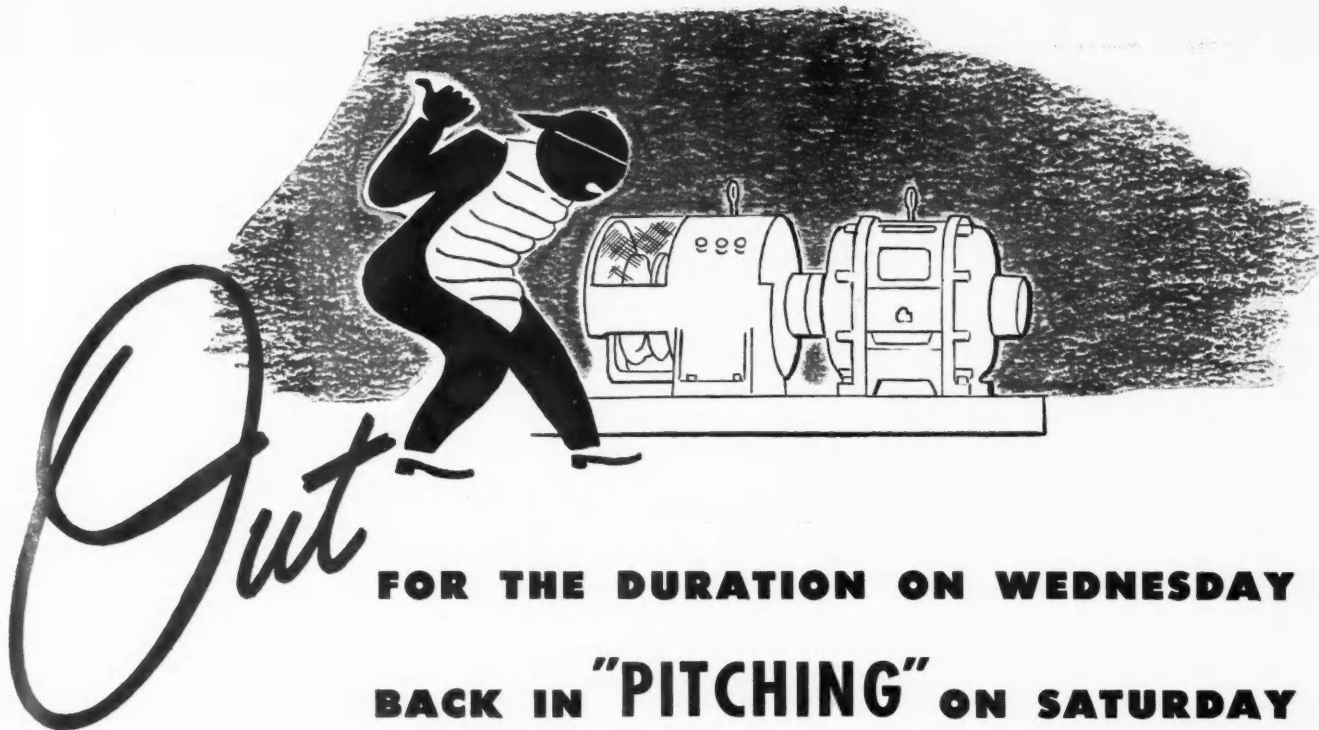
*Westinghouse Type G Hipersil Cores for communication equipment.*

formance. Cores are assembled on coils by means of metal bands tightened to insure correct tension. The butt joint eliminates cross fluxes or masking effect, does not increase core loss. Each joint is equivalent magnetically to .0005 air gap.

For frequencies up to 400 cycles, type "C" Hipersil steel cores of nominal gauge are used. For frequencies higher than 400 cycles, a core using thinner Hipersil steel has been designed, and for very high frequencies and exceptional fidelity, a still thinner gauge is available.

### A Waterproof Cloth Tape

A waterproof, pressure-sensitive cloth tape, which is manufactured without the use of rubber by the Chicago Show Printing Company, Chicago, Ill., is said to be finding uses in war production in a variety of applications. Guns, tanks and aircraft can be sealed with it for overseas shipment. Here its ability to withstand salt spray, dust and



**FOR THE DURATION ON WEDNESDAY  
BACK IN "PITCHING" ON SATURDAY**

PRODUCTION OF 3" SHELLS THREATENED 9:00 A.M. WEDNESDAY.

BROKEN DOWN 50 KW. MOTOR GENERATOR SET DELIVERED TO

WESTINGHOUSE DISTRICT MANUFACTURING AND REPAIR PLANT.

CLEANED, TREATED STATOR WINDINGS. REPAIRED ROTOR RESISTOR.

CORRECTED GROUNDED COIL. INSULATED AND TREATED FIELD COILS.

ASSEMBLED, TESTED AND DELIVERED SATURDAY, 11:00 A. M.

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DISTRICT MANUFACTURING AND REPAIR

J-90464



**IF THE EQUIPMENT NEEDING REPAIR IS  
VITAL TO THE WAR EFFORT . . . PHONE  
THE NEAREST OFFICE OF WESTINGHOUSE  
ELECTRIC & MANUFACTURING COMPANY FOR**

**EMERGENCY SERVICE**

**33 M & R PLANTS . . . ONE NEAR YOU!**





gas contamination is said to be particularly important.

Another feature of this product is its ease of handling and application. It may be stripped off and relocated in spite of the fact that its adhesive power is greater than that of ordinary sealing tapes. Its tensile strength is said to be very high. The cloth stock is so woven that it tears evenly at right angles to either edge. It is packed in rolls of any width up to 36 inches; standard rolls are 60 yards in length.

#### Waterproof Tracing Cloth

An improved White Pencil Tracing Cloth, called Whitex, has been brought

out recently by The Fredrick Post Company, Chicago, Ill. One of the features of Whitex is that it is moisture resistant on both sides. Pencil lines are said to be jet black and opaque on this transparent tracing cloth, due to its fine-tooth surface.

#### Tamplless Case For Extinguishers

The American - LaFrance - Foamite Corporation, Elmira, N. Y., offers an inexpensive extinguisher container, known as the Tamplless Case, designed to reveal any attempt to tamper with fire extinguishers. It is constructed of



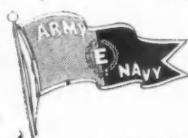
**Tamplless Case for Fire Extinguishers**

tough cardboard stock and houses the extinguisher from the reach of unauthorized persons, yet allows instant removal for legitimate use. One pull on a sealed string breaks through a gummed insignia paper sealing strip and permits the case to unfold. The Tamplless Case may be re-used by folding it around a refilled extinguisher and sealing it with special insignia tape.

## CONTINENTAL RUBBER WORKS



*"This, Then, Is the Time"*



The Aircraft Industry simply does not know how to say, "It Can't Be Done." If seven thousand planes per month are not enough, more will be built. No matter how heavy the pressure for delivery may become, it should be helpful to know that Continental is prepared to work with you in the prompt production of those essential rubber and synthetic parts so vital in airplane performance. Continental's flexible facilities, compact organization and versatile engineering, assure an even flow of materials to meet your delivery schedules however they may change. This, then, is the time to know Continental—better than ever.

**CONTINENTAL RUBBER WORKS**  
*makers of the VITALIC*



**ERIE, PENNSYLVANIA • U.S.A.**  
*line for forty years*

#### Rings for War Machines

(Continued from page 40)

be found in practically every department. However, the final inspection, etching of identification markings, packing, etc., are segregated in a special building set apart exclusively for quality control.

Perhaps it is not yet generally realized that an airplane ring, because of size and special properties, takes from 10 to 15 times the man-hours usually required to produce a passenger car type ring. It may be observed in this connection that the mass production techniques developed by A-H have made it possible to lower the cost of an airplane ring to the point where the ratio of cost is about 10 to 1 as compared with a conventional ring.

Some of the mechanical operations mentioned briefly above will be better visualized by studying the pictorial section containing views selected in various parts of the plant.

Before closing, let us add that the quality and behavior of a piston ring have their genesis in the foundry. Unless the melt is right and properly poured in precisely formed molds, all of the succeeding operations are just a waste of effort. Consequently, the foundry operation is subject to constant laboratory control. Samples are taken of every heat and no heat is poured before the ladle analysis has been approved by the laboratory. In addition, there is a sand lab whose function it is to keep a constant watch over sand quality and sand condition to assure proper mold quality.

In essence, piston ring manufacture is a specialized technical art. It demands know-how, a watch-dog on quality, and untiring research to the end that engines of increasing higher performance may be built with the assurance that such engine will not falter or fail in combat service.



# Freedom

## OF THE PRESS

Never again need production plans be limited by pre-war notions of what industrial presses could do. Even before the war, freedom of the press was demonstrated by Clearing Presses doing jobs never before performed by presses.

Since the battle of production started, the Clearing organization has been responsible for entirely new concepts of the capabilities of presses. Hundreds of vital parts for implements of war were produced, *on time*, because of the engineering skill, ingenuity and production facilities which Clearing brings to press manufacture.

Facts about more efficient, faster and better production methods are important now and will be valuable when planning for the future. So even though you think presses cannot solve your problem, remember that old ideas of the scope of press operations are no longer valid — when Clearing builds the presses.

CLEARING MACHINE CORPORATION  
6499 W. 65th Street, Chicago, Illinois

20 mm. cartridge cases are drawn in this Clearing single action press which brings speed, accuracy and a high production rate to this important operation.

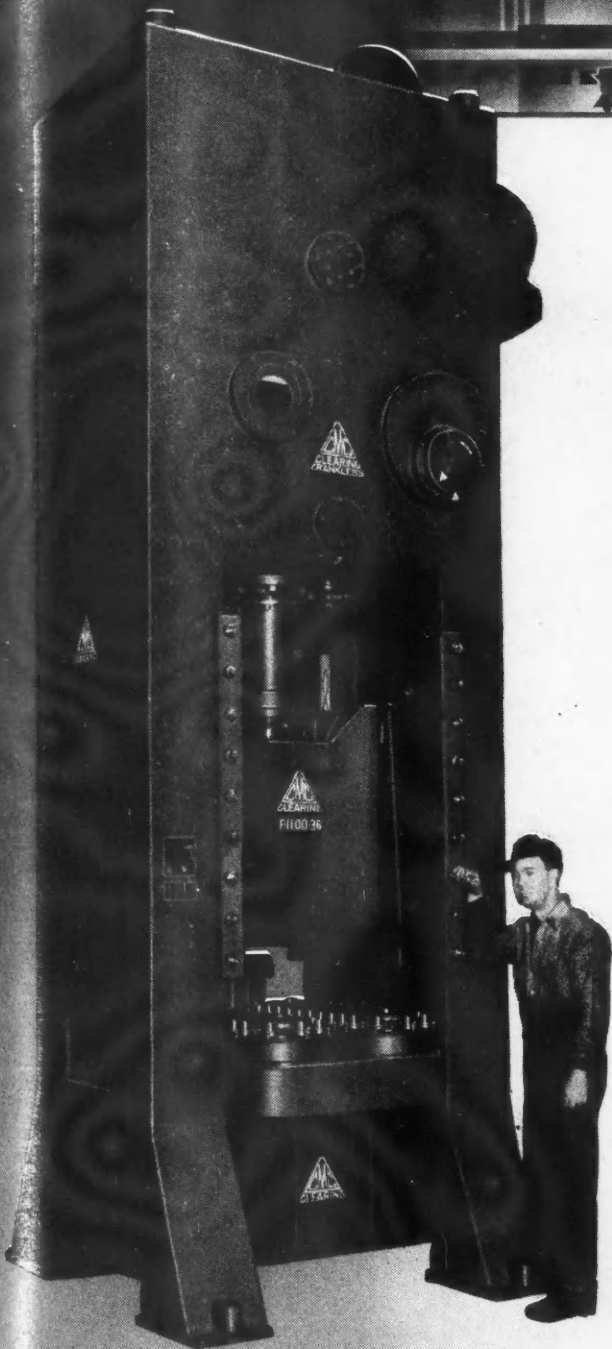


CLEARING

FOR SHAPES OF THINGS TO COME

# CLEARING

MECHANICAL AND HYDRAULIC PRESSES



# Streamlined Inspection System

(Continued from page 25)

Through such stringent policing by the Inspection Department incomplete items have been considerably reduced in final positions. Color banding appearing outside its correct color zone, due to incompleteness, flags that item for all concerned and has assisted in forcing immediate correction.

Squawks, engineering items, shortages, and project sketches are also carried on the inspection form on the following basis:

A. Squawks are handled by the in-

spector who places his stamp and letter "Q" in the preliminary inspection column, noting the correction needed on the reverse side of the card. After correction both the face and the reverse side of the card are signed out to denote clearance.

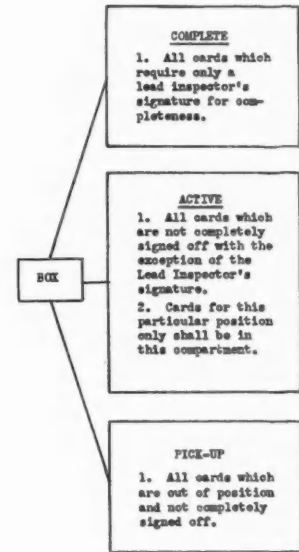
B. Engineering items are handled essentially as listed in "A" except that engineering disposition is obtained and the letter "E" is placed in the "P.I." column (see illustration).

C. Shortages are likewise handled as

listed in "A" except that the letter "S" is put in the "P.I." column under the inspector's stamp.

D. Project Sketches are also handled per paragraph A except that the letters "PS" are entered in the "P.I." column.

The filing system used for filing inspection cards on the unit consists of a three-compartment file identified as follows: A. Complete—those cards completed except for inspection leadmen's sign-out; B. Active—those cards which are being worked on currently; and C. Pick-up—those cards incomplete or which were not cleared in predetermined position. The three compartments are labeled as follows:



For more than two years, we at Atlas have been giving our best in the great war push.

And now that results are beginning to show, we are more eager than ever to follow through with the push that will down the Axis, once and for all.

Amid the smoke and steam and thunder of our hammers, the fierce heat and glare of our furnaces, we are in the thick of things and we won't let up till it's over over there.

**ATLAS**  
**DROP FORGINGS**

ATLAS DROP FORGE COMPANY • LANSING, MICHIGAN

An effort has been made to write the cards in such a fashion that any one portion of an installation may be signed off. In the event of a shift change in the midst of an installation, the inspector going off duty may accept only that portion which has been completed, the oncoming inspector has a record of the amount inspected and can carry on, thereby eliminating duplicate inspections.

The card system has proven its superiority over the previous system on the following points:

(1) A progressive inspection operation outline to standardize procedure and instruct personnel.

(2) Provides a complete inspection record of the airplane per Army requirements.

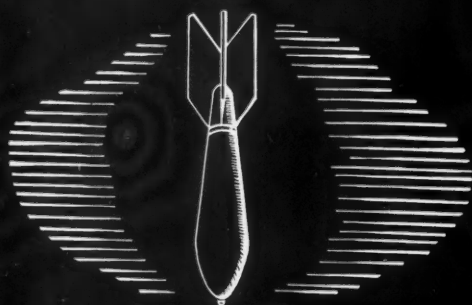
(3) Provides for change of shift continuity.

(4) Initiates quality control by leadmen and fixes responsibility thereof.

(5) Ties installations to position and quickly gives status of airplane (or unit) by perusal of pick-up file.

To sum up, the working value of the system outlined above has amply demonstrated through increased quality, obvious need for fewer highly trained inspectors, and marked elimination of production delay due to confusion as to what constituted quality requirements.





## Who Wins Wars?

Strangely enough, the average man does! Much as we all detest war the fact is that under its stimulation a nation always develops new products with infinite peacetime applications. To date, scores of fantastic devices have been created for war purposes which one day will contribute mightily to the American Way of Life. Weatherhead is producing at the rate of *millions every day* many products that have peacetime application. Just as we've helped build cars, planes and refrigerators in the past, Weatherhead is well prepared to help you build these new products of tomorrow.

Look Ahead with



# Weatherhead

THE WEATHERHEAD COMPANY, CLEVELAND, OHIO

*Manufacturers of vital parts for the automotive, aviation,  
refrigeration and other key industries.*

Plants: Cleveland, Columbia City, Ind., Los Angeles  
Canada—St. Thomas, Ontario

## Latest Type of Equipment at Chevrolet's New Forge Plant

(Continued from page 23)

of the larger crankcases, the forging operation is handled on the 35,000-lb. Erie hammer. It is important to note that the work is trimmed in a press and re-heated for each of the forging operations.

Following this, the finished forgings are given the solution heat treatment, then the aging treatment, as in the case of the blade.

All forgings, except propellers, are dipped in caustic soda solution, rinsed in clean water, dipped in nitric acid, then final-rinsed to bring out surface defects which must be removed in the cleaning room. All forgings go through the cleaning room for grinding and burring and polishing operations before inspection and shipping. This work is done by hand, using the familiar Kellerflex tools.

We mentioned earlier that aluminum forging is hard on the dies and on the machinery. Even the best die steels available have only limited life in this service. As an aid to die life as well as the quality of the forging, Chevrolet uses the best available forging die lubricants.

Before closing, here is a brief comment on the 3000-ton Wood hydraulic press and its principle of operation. It is capable of exerting 6,000,000-lb pressure by means of a water and soluble oil mixture which is pumped under a pressure of 4500 psi, against the top of the ram cylinder. Pressure is created by two 100-gpm Triplex pumps driven by 300 hp motors. An accumulator system is used to store pressure for the press stroke. This system consists of four air bottles and one "air-over-water" bottle. The bottles are 24 ft high and 32 in. ID and have a capacity of 900 gallons each. They have a wall thickness of 6¼-in., built on laminated steel plates welded together. Each bottle weighs 32 tons.

The bottom half of the "air-over-water" bottle is full of water, while the top half contains air at 4500 psi pressure. The four air bottles are connected in series to the top of the "air-over-water" bottle and also contain air at 4500 psi. The system is filled with air by a three-stage air compressor, which takes shop air at 100 psi pressure. It takes two days of continuous operation for the air compressor to make the initial charge in the bottles.

Three storage tanks 28 ft high by 4 ft in diameter are required to hold the hydraulic fluid used in the system. They hold a total of 7500 gallons. This large storage capacity is necessary to supply cool fluid to the pumps.

The press and auxiliary equipment are regulated and coordinated by means of an automatic control system, maintaining a minimum and maximum range of air pressures, water pressures, and water levels by means of pressure gages, switches, and electrical apparatus. Various lights, horns, and bells issue danger warnings to the operator in case of trouble on any of the equipment.

Cast ingots 12 in. by 12 in. by 9 ft long, weighing approximately 1500 lb are received at this plant for crankcase forgings. In that state they have a tensile strength of approximately 39,000 psi. When cogged down, the tensile strength of the billets is increased to 55,000 psi. The cast ingot is heated in a furnace to 720 F, which requires about 3¼ hours. It is removed from the furnace by a manipulator and moved over to the press, where it is cogged down to a 9½-in. R.C.S. billet, using a Vee die. Half of the ingot is cogged down, then placed on a turntable and reversed in the manipulator jaws to cog down the opposite end. The manipulator in this installation has a capacity of 8000 lb. Six levers, each one having three positions, are used in operating the manipulator.



### SLEEVE TYPE BEARINGS

## A complete Bearing Service for the PRODUCTION FRONT

Idle machinery will not win the war. Most delays, caused by bearing failure, can be avoided. Down time can be cut to a minimum. Here's how—

Institute a regular method of inspection . . . once a day for machinery in constant use . . . at least once a week for all others. Make sure the bearings are kept clean, well lubricated and properly aligned.

When failure is inevitable, order replacement bearings in advance. Call in your local Johnson Distributor. From our list of stock items . . . over 850 sizes of General Purpose Bronze Bearings, 250 types of Electric Motor Bearings, 350 sizes of Johnson UNIVERSAL Bronze Bars . . . he can show you how to secure your needs with a minimum of delay. He is listed in the classified section of your telephone book . . . under BRONZE. Keep every machine going on the Production Front.

•  
Write for  
FREE  
Catalogue  
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**JOHNSON BRONZE**  
SLEEVE BEARING HEADQUARTERS  
625 S. MILL STREET NEW CASTLE, PA.



# PRESSES ★ ★ ★ FOR PLANES

America's call for aircraft . . . by the tens of thousands . . . must first be answered with machines for production. Ingots of lightweight alloys must be forged, a myriad of parts must be drawn, shaped or stamped —and hydraulic presses are the tools used for performing these vital operations.

Although we are contributing our utmost to the nation's need for hydraulic presses, our engineering department stands ready at all times for consultation on your hydraulic press problems.



This 3000-ton high speed forging press was specially designed for forging aluminum and magnesium alloy ingots. It is but one of the many types of R. D. Wood presses in use throughout industry.

★ ★ ★

HYDRAULIC PRESSES AND VALVES FOR EVERY PURPOSE

July 15, 1943

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95





# hi-g ELECTRIC HYDRAULIC VALVES



General Controls Type AV-1

General Controls type AV-1, pictured above, weighs only 8½ ounces. This valve is designed for cabin heating, oil dilution and anti-icing applications. Operates in any position, regardless of vibration, change of motion or acceleration. General Controls hi-g Valves are designed for continuous or intermittent duty and are available in a wide range of AN pipe sizes or tubing connections. Also available with a wide range of AN electrical connectors.

hi-g is capable of handling all fluids, gases, vapors and vapor mixes up to 3000 lbs. or more under vibrating conditions. Normally open, normally closed, single seated, pilot piston operated and 3 or 4-way selector valve types. Ask for descriptive bulletin.

\*TRADE MARK—hi-g indicates positive ability to operate in any position, regardless of vibration, change of motion or acceleration.

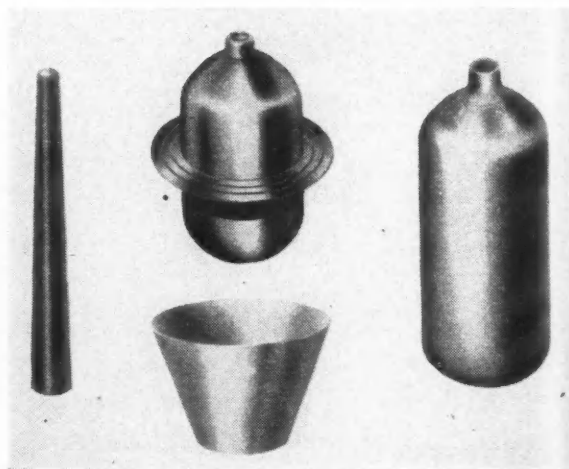
## GENERAL CONTROLS

PIONEERS AND LEADERS IN THE DEVELOPMENT AND MANUFACTURE OF MAGNETIC VALVES  
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## New Development in

## Cold Drawing of Steel

THE PROCESS of cold drawing of steel, which has been in use for upward of 40 years, has been further developed recently to make it applicable to high-tensile alloys as required for aircraft equipment. A good example of such equipment are cylinders for carbon dioxide gas used to inflate rubber life rafts. Cylinders used to store the oxygen required in high-altitude flying are another example. These cylinders must of necessity be light in weight, yet they must be sufficiently strong to withstand the stresses due to gaseous pressures ranging from 1800 to 2000 psi. To obtain the necessary strength without excessive weight it is necessary to use high-strength alloys. Formerly the cylinders were made from alloy steel forgings, and before the open end was closed, the cylinder had to be machined internally and externally to remove excess weight. The raw forging usually weighed about three times as much as the finished cylinder. By applying the cold-drawing process in the fabrication of such cylinders, the amount of alloy steel re-



(Left) Diffuser Tube. 4 in. diameter, 24 in. high.  
(Top Center) Accumulator Housing. 8 in. diameter, 14 in. high.

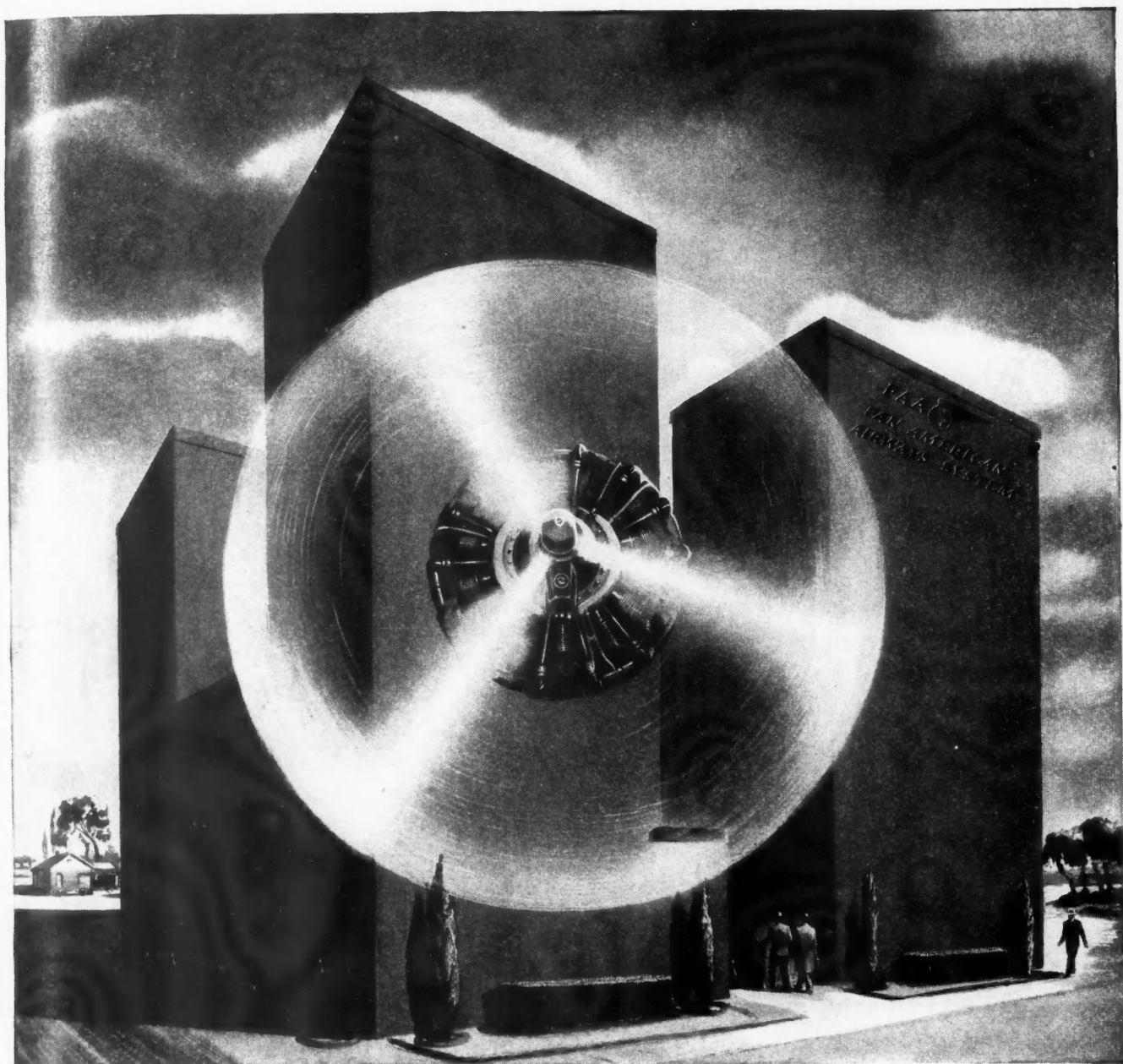
(Lower Center) Special Tapered Shell. 22 in. diameter, 15 in. high.

(Right) Light-weight, high pressure cylinder. 6½ in. diameter, 23½ in. high.

quired per cylinder is said to be reduced by from 50 to 60 per cent.

By what is known as the Hackney process, which has long been worked by the Pressed-Steel Tank Company of Milwaukee, flat circular sheets are first cupped, and then cold drawn to the required diameter and wall thickness. Heat treatments are applied to obtain the necessary physical properties in the finished product. It is claimed that by careful control of the dies and mandrels it is possible to assure uniform side-wall thickness and to produce a smooth cold-drawn finish. In many cases machining can be entirely eliminated.

Another airplane part which can be fabricated to advantage by this cold-drawing process is the oleo strut sleeve which forms part of the landing gear of many aircraft. Accumulator housings of the hydraulic control system also are made by the cold drawing process. High-strength alloy steel is used, and the cold-drawn accumulator housings meet the strength and weight specifications without machining.



## Cave-of-the-Winds in Miami

Inside this unique building, the engines of Pan American Clippers are put through their paces. Propellers roar with the thunder of 4000 horsepower—creating super-hurricanes as air is pulled down one set of stacks and pushed out through the other set.

Outside, there's hardly a sound—for in each stack a honeycombed unit of cells soaks up the resonance, bit by bit, until it is finally dissipated.

Naturally, this completely windowless test house had to be air conditioned—to remove heat generated by the engines, to provide controlled

testing temperatures, to make working conditions bearable for the engineers. As in so many other exacting applications of air conditioning and industrial refrigeration, the equipment selected was General Electric.

Today, G-E air conditioning and refrigeration engineers are devoting all their talents to problems of war

production and testing. They are learning much that will lead to better, more economical manufacturing methods—to healthier, happier living—when we return to the pursuits of peace.

*Air Conditioning and Commercial Refrigeration Division, Section 437, General Electric Company, Bloomfield, New Jersey.*

*Air Conditioning by*  
**GENERAL  ELECTRIC**

## Training Aircraft Engine Mechanics

(Continued from page 18)

technical orders. After completing this course, the graduates are qualified as engine overhaul mechanics on this P & W engine, ready for third echelon work. Trainees are quartered in temporary wooden barracks adjacent to the Ford Rotunda. William F. Mueller is the school supervisor for Ford.

Packard Motor Car Co. also was an early participant in the training of aircraft mechanics, inaugurating a course to instruct AAF personnel in

the Packard-built Rolls-Royce engine, at its Detroit plant in March, 1942. The Packard course embraces familiarization and actual work on the 12-cylinder V-type engines. Personalized instruction for the trainees is emphasized. There is an instructor for every five students and an advisor for each "flight" of 15 students. The advisor accompanies the "flight" at all times during the training course, and thus knows when any student requires special in-

struction or added study. The highest ranking student in each "flight" is appointed the "flight" leader. Classes are small. During actual work on the engines in the assembly and disassembly of various units, the groups are split into small details of five men.

Visual education is an outstanding feature of the Packard course. Twelve instructional movie films on the Packard-made Rolls-Royce engine and 11 others on such related subjects as the airplane, equipment, instruments and accessories are shown during the course. Cut-aways, drawings, animated models, charts, diagrams and "exploded" blowups also are employed to advantage by the instructors. AAF technical orders are used as text books to familiarize the students with the orders which they will have to follow in the field. The trainees are graded daily on the basis of practical tests on each phase of the course, application, aptitude, cooperation, reliability and practical ability on actual engine work. This grading is done by the flight advisors on progress record sheets which accompany each student through the school.

After detailed familiarization with the engine design, construction, lubrication and equipment, the trainee is ready for application of this learning to the engine itself. He becomes familiar with the installation and adjustment of all control settings, valve and ignition timing, manifold pressure regulator operation and magneto operation and maintenance. Then comes a detailed study of the induction, fuel and oil systems in which the installation, inspection and overhaul of the carburetor, fuel and oil pumps is undertaken by the student.

Next each detail of five students completely disassembles a Rolls-Royce engine by major units and assemblies, cleans and inspects each part and reassembles each unit and subassembly into the completed engine. The trainees also observe the putting together of the engines in the "green" assembly department of the adjacent Packard factory in order to familiarize themselves better with the sequence of operations and the construction details of the powerplant.

The subject of engine repair and overhaul is broken down into seven separate stations, the students progressing from station to station in the sequence that the engine is disassembled and assembled. The seven stations are (1) upper crankcase, crankshaft, connecting rods, oil lines and oil test; (2) reduction gear and dual drive; (3) cylinder banks, pistons, camshafts and rocker mechanisms; (4) wheelcase, upper and lower vertical drives, spring drive, supercharger clutches and speed-changing mechanism; (5) supercharger and induction; (6) lower crankcase, minor repairs; (7) accessories, oil lines, ignition harness, miscellaneous fittings and connections to make engine ready for block

## DON'T LET THE CHIPS

*fall where they may!*

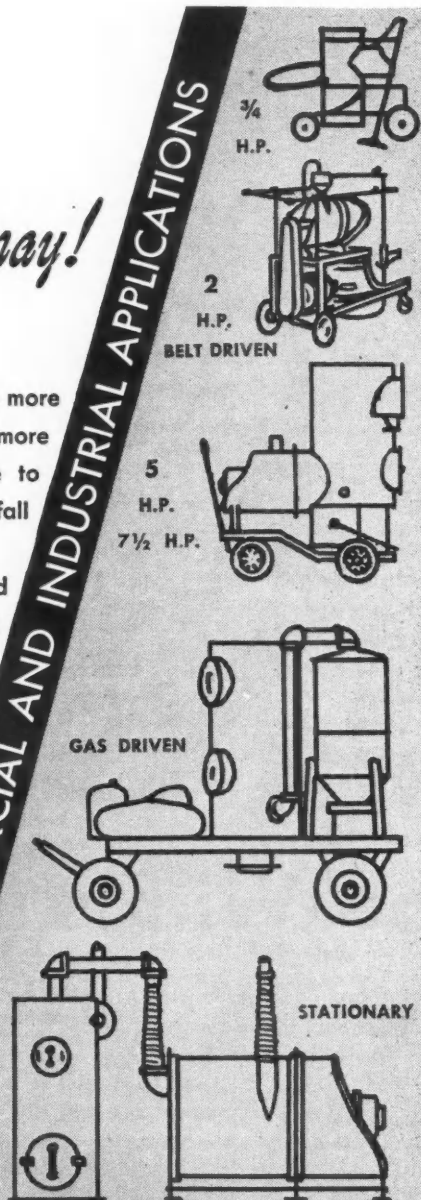
More production means more chips — more dirt — and more dust in your plant — more people working and fewer people to clean. And you can't let the chips fall where they may.

Spencer Vacuum is helping build planes, guns, and tanks in a dozen ways. It keeps debris off the floor, dust off the walls and the work, and dirt out of the machinery. It is ideal for bench cleaning, or for reclaiming valuable materials such as metals, powders or fibres.

It cleans the product — between processes — before painting — before delivery.

The Spencer Portables shown on this page are Standards. Stationary systems also made up to 100 horse power. Ask for Bulletin No. 125.

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# Wartime Guide to



# ELECTROPLATING PROCESSES

Wartime production has greatly expanded the use of electroplating. Specifications have been revised. Increasing demands are being made on platers for production of finishes on a wide variety of articles for military and ordnance requirements.

Many of the present day needs can be met through the use of one or more of the du Pont processes listed here. A competent group of technical men with many years of experience in all types of plating will be glad to discuss your plating problems and help in the selection and application of appropriate processes. E. I. du Pont de Nemours & Company, (Inc.), Electroplating Division, Wilmington, Del.



## ELECTROPLATING PROCESSES and MATERIALS

BETTER THINGS FOR BETTER LIVING... THROUGH CHEMISTRY

**"ZINOLYTE."** (Bright Zinc). Bright deposits directly from baths made up with prepared salts.

**"DUROBRITE"** (Formerly called Du Pont Bright Zinc). For production of bright deposits from solutions made up with standard chemicals.

**DUCTILE ZINC.** Matt white deposits, suitable for deep drawing and sharp bending.

**STRAIGHT CYANIDE ZINC.** Easily controlled plating solutions for production of fine grained, rustproof deposits.

**SILVER.** Heavy coatings... adherent and fine-grained, 0.01" or more, can be produced using current densities as high as 50 A./SF.

**HALOGEN TIN PROCESS** — For high speed plating of strip steel.

**STANNATE PROCESS.** Practical, economical method for strip steel and general purpose plating.

**HIGH SPEED COPPER.** For rapid, economical production of heavy, smooth, bright deposits at high current densities.

**SULFAMATE LEAD.** Easily made up and maintained with prepared salts. Smooth, dense, pore-free coatings from 0.0001" to 0.0025" readily obtained.

**"CADALYTE."** Salts and Maintenance Compound for rapid, efficient production of bright cadmium deposits.

**STANDARD and SPECIAL CHEMICALS.** For Gold, Cadmium, Copper, Chromium, Nickel, Brass, Bronze, Tin, Zinc, Silver, and Lead plating.

test or installation in an airplane.

Testing engine operation, trouble shooting and installation in the airplane complete the Packard course. Testing by the students is now accomplished on production dynamometers but a new testing building is nearing completion in which the students will be able to test the engines with regulation propellers and aircraft instruments. The trainees also are instructed in the installation and removal of the engine from an actual plane. For this purpose, the Packard school has secured some outworn fuselages and these are rigged up in the shop to simulate actual working conditions in the field. They also are trained to make repairs with

a minimum of tools and are given the latest reports on field maintenance. Upon graduating from the school, AAF soldiers receive certificates recognizing their competence as mechanics on the V-type engine. G. W. Rapin is manager of the Packard Aircraft Engine School.

Buick and Chevrolet Motor Divisions of General Motors both are conducting schools for mechanics on the Pratt & Whitney 1200-hp engine which each of these manufacturers is making for the Army Air Forces. This engine is extensively used by the Air Forces in both bombing and transport planes, so the need is great for large numbers of competent overhaul mechanics. The classes are staggered, one group graduating

every week and another new group entering the schools from the basic training centers each week.

The Buick school, which is housed in a former service building at Flint, enrolled its first class in May, 1942. Approximately 15 per cent of the time at the Buick school is devoted to problem discussion, and the remainder to actual manual instruction in teardown and overhaul of the engines. More than 30 Buick-built aircraft engines help familiarize the students with the subject. Forty-five men drawn from Buick's field organization serve as the school faculty. The school, which is directed by W. F. Hufstader, Buick general sales manager, last fall won the top efficiency award in the second district of the AAF-TTC, comprising nine central states.

The Chevrolet school, which opened in October, 1942, occupies a former automobile sales and service establishment in Detroit. Its large teaching staff of 64 instructors is composed of former Chevrolet service representatives, who have averaged 16 years apiece in automotive maintenance work. All the men were first trained at the Pratt & Whitney plant in East Hartford, Conn. Practically all of the course is being devoted to practical maintenance instruction in the various phases of engine overhaul and repair. One engine is provided for every five men and during the course each student completes at least one full disassembly and assembly operation. The school building which occupies 68,000 sq. ft., includes a projection room, 33 individual workshops, a dining hall and offices. Ed Hedner, Chevrolet service manager, is in charge of the aircraft training school. Both the Chevrolet and Packard AAF trainees are quartered in downtown Detroit during their attendance at the schools.

In peacetime the well staffed service organizations of the automobile companies spent much time and effort in keeping their automobile dealers advised as to the latest innovations in maintenance technique. Elaborate booklets, slide films and movies were prepared every fall to keep the dealers, their mechanics and service managers up-to-date on any mechanical or operating changes in the new models. If a radical change in body or engine was made, an intensive educational campaign was conducted among the dealers in the various cities by the service experts. All this was designed with a view to "keep 'em rolling" and to maintain the customer goodwill of the automobile owner through thorough service.

Now the automotive industry's familiarity with field service has been converted to the wartime task of training aircraft mechanics by the thousands. The product to be serviced is more complicated but the principles of instruction are the same.



All glory to our fighting men. We are proud of them.

It is a source of satisfaction to us at Detrex to know that our processes are helping in the war effort.

Speed, vital to our War Supply and Armament Production, is graphically illustrated by advancements in industrial cleaning methods over World War I. Work that took half an hour or more to clean in those days is now Detrex Degreased in a minute... and the cleaning is more thorough, too! Imagine the saving in production time and cost.

Projectiles, Radar, Aircraft, Mobile Equipment, Guns and Control Apparatus—to mention a few of the many Detrex war production cleaning applications—are all Victory bound. Detrex equipment is "In the Service", even up to the front where it is used in repair and maintenance cleaning.



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**DETROIT REX** PRODUCTS COMPANY

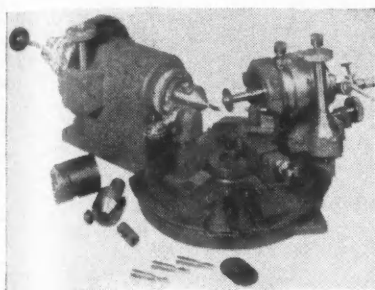
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## New Production Equipment

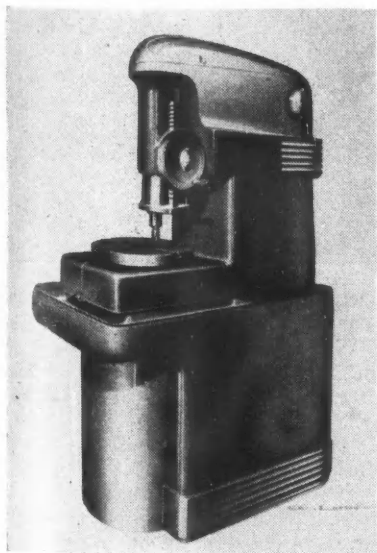
(Continued from page 46)



Onsrud GF-41 bit grinder

In operation, the bit to be sharpened is held in the chuck and moved to and away from the grinding wheel by means of a hand lever. Feed of the bit is controlled by a cam to give proper bit lead. A leather bellows, automatically operated as bit feed movement takes place, keeps dust from lapped surfaces.

A SIMPLE, low cost automatic profile milling machine has been developed by the Earl A. Thompson Mfg. Co., Ferndale, Mich. A few of its features are—complete automatic hydraulic control of feed and rapid traverse, spindle quill lock, spindle drive clutch, brake and work table stop. A pressure and gravity lubrication system is built into the machine. All working parts are fully enclosed for safety and for protection from chips and dirt.

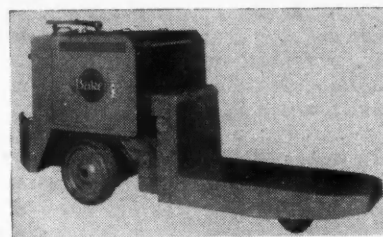


Thompson automatic profile milling machine

The head carries the cutter spindle, mounted on precision Timken bearings, within the quill. The quill has a silent chain drive and hardened, helical change gears, running in oil. The head is adjustable to 0.001 in positioning for work. The spindle and table are

independently driven and controlled. The spindle has selective speed range from 127 to 3435 rpm.

Work is carried on a 14-inch rotating table, hydraulically controlled by an accurate cam and follower mechanism. Ground center hole in table facilitates positioning of work-holding fixtures. Two program discs determine rapid indexing cycles and automatic table stop to meet the requirements of a wide range of work.



Type E-2 Low Lift Truck

A 400 lb. capacity Low-Lift truck, designed to give longer hours of uninterrupted operation, has been brought out by The Baker-Raulang

# Castolin Eutectic

## LOW TEMPERATURE WELDING

**SIMPLIFIED DESIGN**

**FASTER PRODUCTION.**

MADE POSSIBLE WITH

### CASTOLIN EUTECTIC

### ALLOY No. 16



**PROBLEM**

Fabrication of this intricate steel aircraft tubular assembly with high temperature fusion welding was impractical because the high heat resulted in distortion and softening of the metal. Additional time required for machining the joints rendered the process too costly.

**SOLUTION**

Castolin Eutectic Alloy No. 16 eliminated the distortion and softening of the metal. How? This Low Temperature alloy binds at 1300° F. • Gives tensile strength of 117,000 lbs. per sq. in. • Three times faster than fusion welding • One third the cost of silver solder — three times the strength • Clean thin fillets eliminate after-machining.

Castolin Eutectic Alloy No. 16 for use on all steels: chrome-moly, chrome nickel, high speed vanadium steel, iron and malleable iron. Also for joining these to other metals.

Only "Eutectic\* Alloys" are the true Low Temperature Welding Alloys that are revolutionizing production welding, maintenance welding and salvaging in war plants throughout the nation. There are 42 specialized rods for every metal and every welding job. Developed and manufactured only by Eutectic Welding Alloys Company.

\*Reg. U. S. Pat. Off.

New 36 page Welding Data Book H Write Today

**EUTECTIC**  
**WELDING ALLOYS COMPANY**  
 SOLE MANUFACTURER - CASTOLIN EUTECTIC WELDING ALLOYS  
 40 WORTH STREET, NEW YORK, N.Y.



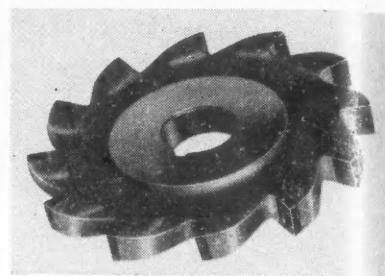
Company, Cleveland, Ohio. This truck, known as the Type E-2, is built on a 66 in. wheelbase and its overall length is 123¾ in. It can make right angle turns in aisles 67 in. wide.

The battery box has been increased to 32 in. by 39½ in., providing space for additional battery capacity so that it is not necessary, under most conditions, to stop during a working shift to change batteries. The front top edge of the battery compartment has been chamfered to improve visibility. The operator's guard is integral with the frame, providing greater strength and additional operator protection. The travel brake, which is located just be-

low the control panel, is adjusted by a single hex nut, which is out in the open where it is easily accessible.

**A** LINE of carbide tipped milling cutters with cast alloy bodies has been placed on the market by the Super Tool Company, Detroit, Mich. The maker claims that many of these cutters are being used successfully in steel at surface speeds of 400 to 600 feet per minute, with tooth load varying with the hardness of the steel from .0005 in. to .0025 in.

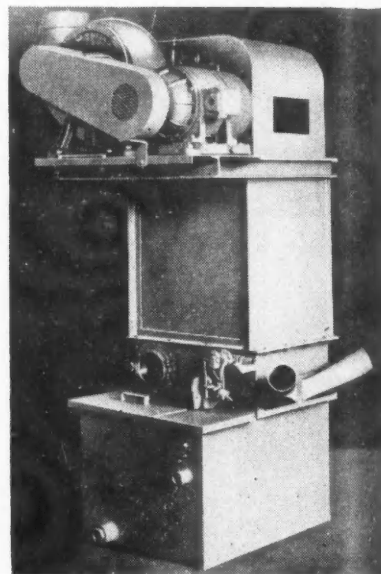
Standard cutters for cutting cast iron, brass, bronze, copper, aluminum, magnesium, and plastics are supplied in



*Carbide tipped milling cutter made by Super Tool Company*

diameters from 3 in. to 8 in. in a variety of widths. These tools have 4 or 6 flutes. For cutting steel, various sizes are made with 6 to 16 flutes according to the diameter.

**A** SMALL size unit has been added to the line of orifice-type collectors made by the Industrial Equipment Corporation, Detroit, Mich. It has a capacity of 1200 cu. ft. per min. and has been designed especially to meet the requirements of double spindle

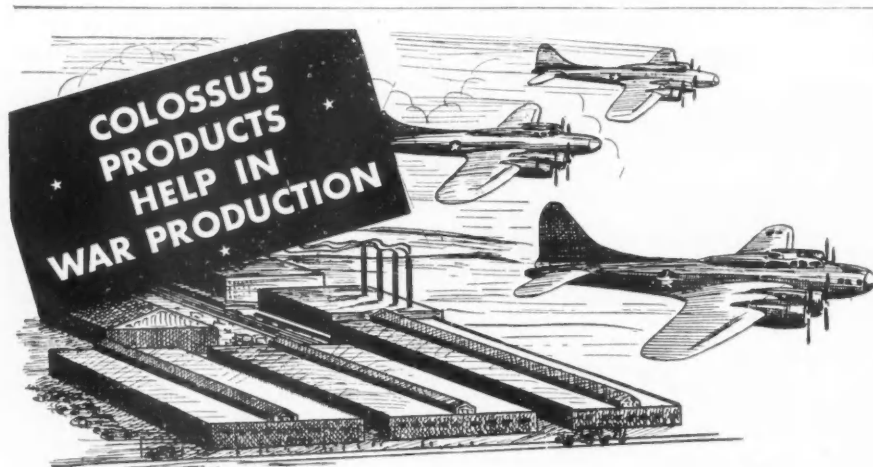


*Orifice type dust collector made by Industrial Equipment Corporation*

grinding and buffing lathes, although it is adaptable to many other kinds of work.

It is said to be particularly effective in work with magnesium. The cleaning action is caused by the scientifically directed movement of air through an orifice. A compartment at the side collects the sludge and permits its easy removal. Water level is controlled by a specially constructed diaphragm valve.

**A** NEW-TYPE wrench made of lightweight Plexiglas and designed for assembly operations on radio equipment used by the U. S. Navy Bureau of Ships has been designed by Wells-Gardner Co., Chicago, Ill.



American Industry some time ago converted from civilian to war-time production. Colossus Brand products kept pace with the change and are anxious to work with you on any finishing problems that may come up in *your conversion*. Rhodes is grateful for the commendations received from war goods producers.

#### **COLOSSUS BRAND\***

**WHITE SPANISH FELT WHEELS & BOBS** are made in a full range of diameters, thicknesses, densities to meet your specific polishing requirements.

#### **COLOSSUS BRAND\***

**CUT FELT** includes innumerable precision die cut Felt parts, such as Gaskets, Washers, Seals, Wicking, etc.

#### **COLOSSUS BRAND\***

**FELT** is available in many qualities, densities, and thicknesses for all industrial uses. Let us show you how Felt can do a better job for you on vibration control, insulation, oil retention, oil transmission, shock absorption, packing, polishing, or many other specialized applications.

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**COLOSSUS BRAND\* PRODUCTS** Rhodes' industrial polishing, abrading and cleaning products include — Aluminide (*Aluminum Oxide*) . . . Dicarbo (*Silicon Carbide*) . . . Rouges . . . Powdered & Lump Pumice . . . Steel Wool . . . Sponges . . . Chamois.

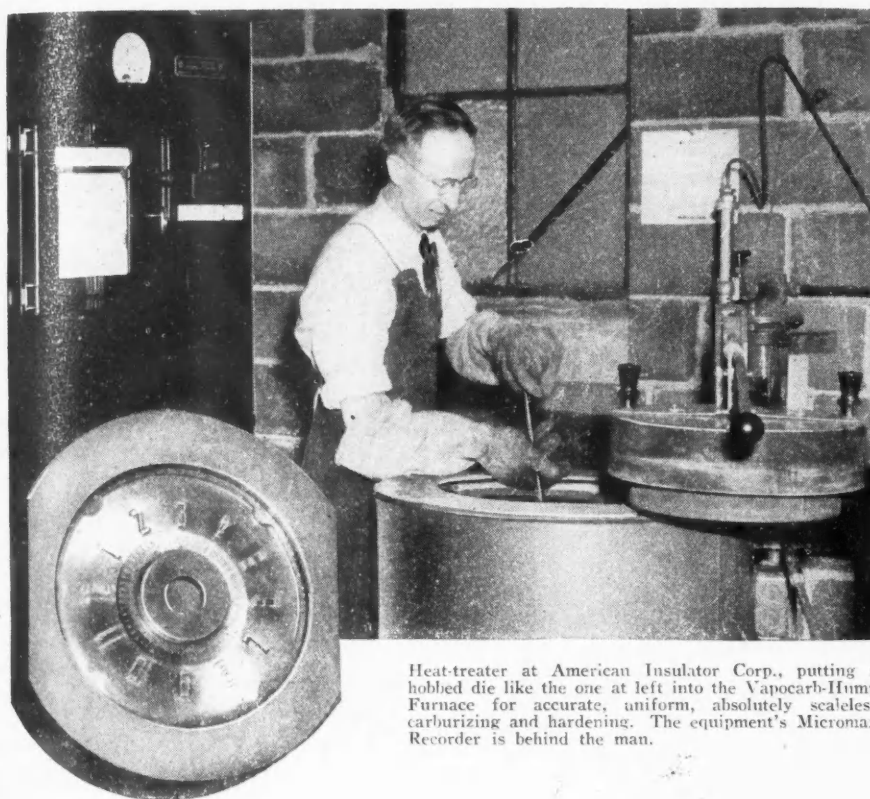
*\*Colossus Brand stands for four decades of manufacturing, mining and milling experience*



# **JAMES H. RHODES & COMPANY**

157 W. Hubbard St., CHICAGO, ILL. • 48-02 Twenty-Ninth St., LONG ISLAND CITY, N.Y.

**For further information write for our latest catalog.**



Heat-treater at American Insulator Corp., putting a hobbled die like the one at left into the Vapocarb-Hump Furnace for accurate, uniform, absolutely scaleless carburizing and hardening. The equipment's Micromax Recorder is behind the man.

## WAR-BUSY TOOLROOMS

### Use The Vapocarb-Hump Method For Successful Hardening

How well the Vapocarb-Hump Method of hardening meets the varied needs of today's busy toolrooms is illustrated by the experience of the American Insulator Corp., New Freedom, Pa.

This firm's normal production is a wide variety of plastic articles. These are manufactured by die-molding, and the heat-treatment of the molding dies introduces two problems—carburizing the dies, and hardening the hobs or punches with which dies are formed.

In carburizing, the dies must be kept absolutely "clean" and unpitted, or many man-hours will be spent in "polishing out" the flaws. In hardening the punches, results must be correct, or the expensively-engraved tool may distort or break, when a hydraulic press forms a die by forcing the

hob into a block of iron; and a tool engraver will then spend weeks making another punch.

Both carburizing and hardening difficulties have been overcome with the help of the Vapocarb-Hump equipment shown above. In carburizing, the dies are put, absolutely bare, into the Furnace. At about 1200 F the heat-treater admits Vapocarb gas; this replaces all air in the furnace, blankets the dies in a carbon-rich vapor from which all impurities have been eliminated. When the dies reach carburizing temperature, the Furnace's Micromax Controller automatically holds them constant, while they absorb as much carbon as the heat-treater wishes. Then, after he skillfully quenches them, they are as "clean" as when they entered the Furnace.



**A Slogan For All Americans**

In hardening hobs, where deep-seated strength as well as perfect surface must be attained, the heat-treater uses the Hump Method to its full extent. He first employs the Micromax Recorder to find how fast the hob "likes" to heat; then he sets the instrument's control dial so that this rate will not be exceeded as the steel reaches its critical stage.

Having thus assured correct heating, the heat-treater watches for the "hump" by which the hob indicates, on the Micromax chart, that it is in the critical range. Knowing how far past the critical the tool should heat, the heat-treater quenches at that point; freezes the structure there; assures long life for the tool.

Vapocarb-Hump Hardening is further described in Catalog T-621, but if you have a war-work problem in tool hardening, an outline of the problem to us will get fast, direct action.



A PRODUCTION LINE APPLICATION

Automatic controls which the foreman sets, and which hold the Vapocarb-Hump just as he wishes, make this method of hardening ideal for women operators. This scene is in a large Canadian plant.

Int Ad T-621(30)



LEEDS & NORTHRUP COMPANY, 4966 STENTON AVE., PHILA., PA.

**LEEDS & NORTHRUP**

MEASURING INSTRUMENTS • TELEMETERS • AUTOMATIC CONTROLS • HEAT-TREATING FURNACES

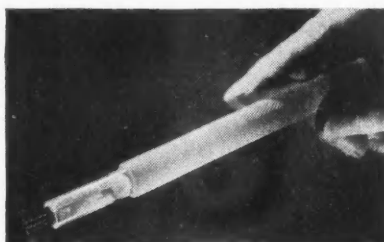
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105

*Wrench made of Plexiglas. Photo courtesy of Rohm & Haas Co., Philadelphia.*

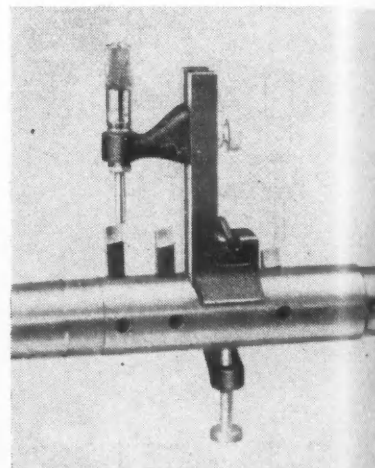
and the Klise Manufacturing Co., Grand Rapids, Michigan. The new Plexiglas wrenches are used for tightening hexagonal nuts in aligning intermediate frequency coils in Naval radio sets. A material of high dielectric strength, ready machinability, and toughness is necessary for this job, and Plexiglas filled the bill. It is resistant to weathering and aging and it may be machined, drilled, and threaded like any soft metal.



**B**ARTELT Engineering Company, Beloit, Wis., is offering the Model B Pedestal Micrometer, primarily designed for setting closely-spaced boring tools, and also useful for other gaging

purposes. The gage consists of a pedestal having a base with a wide vee opening and flat surfaces at the ends of the extensions, a removable clamp, and a micrometer head mounted in an adjustable arm. The vee groove provides a firm support when the gage is placed on a boring bar and held by the removable clamp. The flat portion of the base permits the Pedestal Micrometer to be placed on a flat surface, and used as a height gage or depth gage.

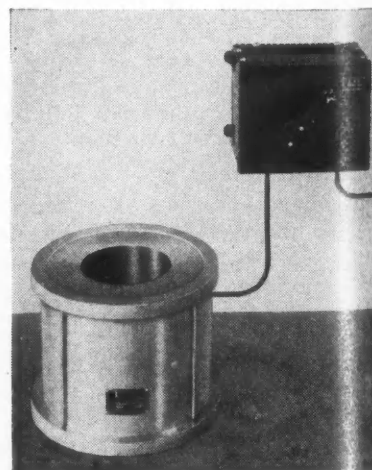
The upright portion of the pedestal is finished on both sides. The arm which carries the micrometer head is



*Model B Pedestal Micrometer*

clamped to the vertical surface with a screw through a slot in the upright. As the pedestal is double-faced, the arm may be clamped to either side as desired, and can be changed from one side to the other without changing the clamped position of the pedestal. Three clamps are furnished, to fit all size boring bars from 1 in. to 5 in. diameter.

**T**HE LEE CUB bench-type carburizing furnace, designed for use with accelerated carburizing salts, is now in production at the Lee Grinder Company, Chicago, Ill. The furnace may



*The Lee Cub bench-type carburizing furnace.*

PHOTO BY U.S. ARMY SIGNAL CORPS.



**Constant Research plus Rigidly  
Controlled Production is Producing  
More Efficient Sterling Pistons for:**

**Tanks  
Trucks  
Airplanes  
Busses**

**Marine Engines  
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Write today if our years of experience in creating aluminum pistons can help you solve your problems.

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**STERLING  
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# SENTRIES

## On Motorized Life Lines



TANK OIL FILTER PANEL—built by AC since Pearl Harbor

AUTOMOTIVE OIL FILTER—built by AC since 1926



THERE is nothing heroic about that battery of oil filters clamped against the engines of General Sherman tanks. But, without them, those engines would shortly be wrecked.

To prevent this, the Army equips with Oil Filters built to exacting Army standards; tested for durability and efficiency at home—and now, in battle; these filters stand constant guard against dirt in lubricating and fuel oil,—life's blood of the power plants.

Except for size and certain details, these Army AC Oil Filters are identical with those which have kept engine and fuel oil clean, for years, for millions of American motorists. Both are scientifically engineered. Both are precision built.

Army mechanics and tank crews know that those filters must be kept functioning. So, the elements are changed in strict accordance with Army procedure.

That's why *your* engines, too, need oil filter protection, and why the element should be replaced regularly.

Conservation is the order of today. And it is easy to get through the service which America's mechanics are now rendering. This is being augmented by contacts from AC, carrying to all service organizations the latest and most practical methods of diagnosis and repair for AC products. Details of this Service are given in the panel below. For your own sake, and to conserve America's precious gasoline, oil, and tires, we urge you to use that service.

When replacement is needed, select AC—and be sure of complete satisfaction.

*Awarded to AC on September 2, 1942, for outstanding achievement in producing for Victory.*

AC SPARK PLUG DIVISION  
GENERAL MOTORS CORPORATION

**SPARK PLUGS**—Dirty or worn plugs waste as much gas as one coupon in ten. Oxide coating collects on the plugs and causes them to misfire, especially when the engine is working hard. Dirty plugs also cause hard starting which weakens your battery. Under present slow driving conditions, have your plugs cleaned and adjusted every few months.



**AIR CLEANERS**—A dirty air cleaner increases gasoline consumption because it chokes down the flow of air into the carburetor. Your air cleaner should be rinsed whenever your car is lubricated.



**FUEL PUMPS**—Practically trouble free. But, if yours has been in use thirty or forty thousand

miles, it may be worn to the point where a check-up is due.



**DRIVING INSTRUMENTS**—Speedometer, gasoline gauge, oil pressure gauge, ammeter, and temperature gauge seldom need service. But, if they give trouble, have them cared for at once.



**OIL FILTERS**—Slow driving accelerates the formation of soot and carbon in engine oil. If not constantly filtered from the oil, this dirt will clog piston rings, which causes increased consumption of oil and gas. So, replace your oil filter element whenever your dealer's AC Oil Test Pad shows that your oil is dirty.

BRING VICTORY QUICKER—BUY U. S. WAR SAVINGS STAMPS AND BONDS

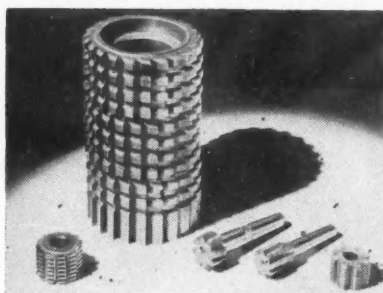
AC is carrying Conservation Service into the field to be helpful to all those who use and service AC products; and bringing before them the high quality and precision manufacturing—for civilian and war products, alike—for which AC has been known for more than thirty-four years.

Reproduction of current advertising appearing in national and farm publications.

July 15, 1943

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be operated intermittently or continuously on any 110-130 volt circuit. Regulation of the temperature for hardening carbon steel is provided by the control unit which combines switch, magnetic circuit breaker and voltage control. The control can be set to "coast" the bath at low temperature when required for intermittent operation. The furnace is designed to operate at a maximum temperature of 1600 deg. F. It is 13½ in. in diameter by 11 in. high. The seamless, corrosion-resistant pot is 6 in. deep by 6¾ in. in diameter.



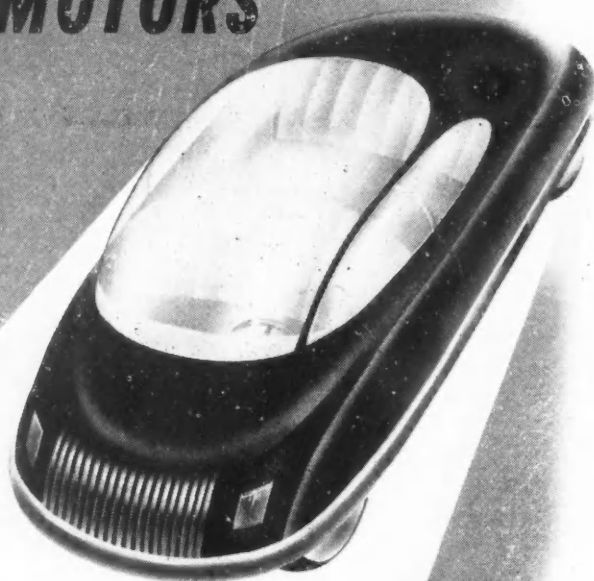
**T**HE Plan-O-Mill Corporation, Hazel Park, Mich., announces a line of multiple thread milling cutters in Na-

*Plan-O-Mill thread milling cutters*

tional, Whitworth, Acme, V, and special forms. These are offered either ground or unground, for use on any type of thread milling machine. The maker claims that, due to improved design, these cutters have greater resistance to breakage and produce more finished parts per grind.

Plan-O-Mill thread milling cutters are available with straight or spiral flutes, with or without special tooth for removal of imperfect thread.

## **ALWAYS A Controlling Factor ON MOTORS**



● In Summer or Winter . . . in war or peace . . . with new models or old models revised . . . we believe Dole Thermostats will continue to regulate motor temperatures for maximum operating efficiency—saving gas, oil and the motor.

## **THERMOSTATS and Leak-proof Primers**

by the

# **DOLE**

**valve company**

Devoting Production Facilities Almost  
Entirely to War Necessities  
1901-41 Carroll Ave., Chicago, Ill.  
Los Angeles • Detroit • Philadelphia

### **Spray Gun of Non-Strategic Materials**

To overcome the difficulty experienced in securing aluminum and other critical materials, the Binks Manufacturing Company, Chicago, Ill., are now pro-



ducing this New Thor No. 17 Gun for quick deliveries in war time. While not possessing an elaborate finish, the new gun is said to equal the performance of the other models which it replaces.

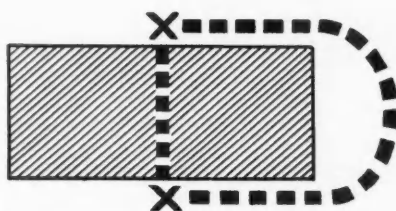
### **New Clearing Assembly Plant**

Completion of a new assembly building has substantially increased the productive capacity of the Clearing Machine Corporation, Chicago. Of steel construction, the new addition to Clearing's plant is 70 feet high. Any required future expansion has been provided for by making the back wall of the structure a temporary one. The 24 inch reinforced concrete floor is capable of sustaining a load up to 1,000,000 lbs. as distributed by the base of a press. Two lift cranes with capacities of 50 and 100 tons respectively have been installed. Distance from crane hooks to floor is 50 feet. With operations already under way in the new building, Clearing Machine Corporation is now in a position to increase its output considerably.



**IF YOU CAN'T GO *THRU***  
**GO AROUND . . .**

WITH  
**WALKER-TURNER**  
*Flexible Shafting*



Don't cramp your style by trying to stick too rigidly to the "straight and narrow path" in remote control and light power transmission. With WALKER-TURNER FLEXIBLE SHAFTING you can take your choice between going *through* or going *around*. Oftentimes it offers the only practicable solution to knotty problems in mechanical design, as many aircraft builders—among others—have learned. Maybe you are struggling with some application today on which you could use a little of our experience. Take it up with us.

**WALKER-TURNER COMPANY, INC.**

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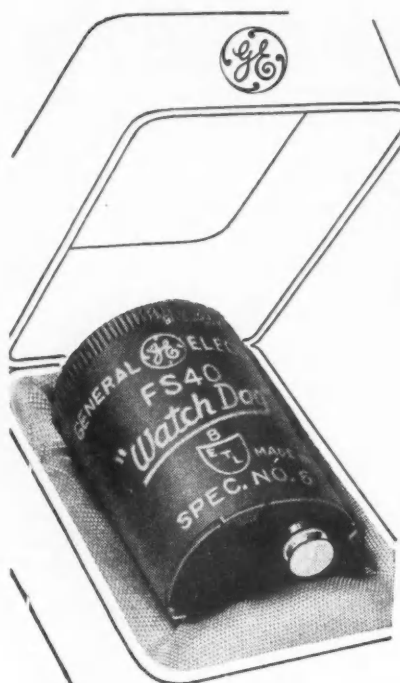


**walker-Turner**  
COMPANY, INC.  
PLAINFIELD, N.J.  
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**FLEXIBLE SHAFTING**

**FOR REMOTE CONTROL AND POWER TRANSMISSION**





*It's a "Gift"*  
for

## FLUORESCENT USERS

G-E's new fluorescent starter, the FS-40 "Watch Dog" for 40-watt lamps, is like a gift — something you always wanted but couldn't get.

It will give far longer service\* than average; end blinking and flickering; prolong lamp life; protect the ballast and cut maintenance time to a minimum. It is a precision lamp starter and precision lamp stopper designed for more economical, more satisfactory fluorescent lighting.

For detailed data substantiating these claims send the coupon below.

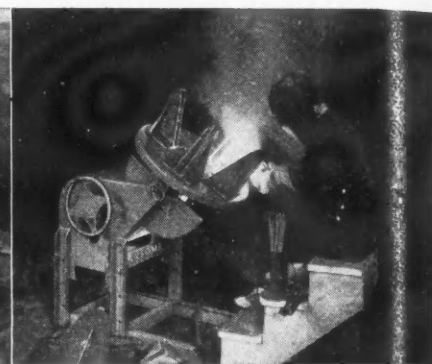
\*Under specified test conditions the "Watch Dog" outlasted an average of ten 40-watt lamps — the equivalent of 25,000 hours of lighting service.

Section G731-103  
Appliance & Merchandise Dept.  
General Electric Co.  
Bridgeport, Conn.

Gentlemen: Please send additional information about your new FS-40 "Watch Dog" Starter to:

Name.....  
Company.....  
Address.....  
City..... State.....

**GENERAL ELECTRIC**



## Now... A 500-POUND WELDING POSITIONER BY RANSOME... Motor or Hand-Operated

Here's a versatile machine that will help you do better welding faster... on a wide variety of work. It's top-quality equipment and ideal for women welders.

- Table top tilts to 135° from horizontal (45° beyond vertical).
- T-slots in table top simplify clamping of work.
- Handles a 500-lb. load with a 6-inch center of gravity and a 6-inch eccentricity.
- Cut gears are used throughout.
- Clutch permits free rotation of table top, by hand.
- Available with elevating base to give 42 inches from floor to table top.
- On motorized machine, Reeves variable-speed drive gives range up to 1 r.p.m. for table rotation. Choice of power or hand-wheel tilting.

Other Ransome Positioners cover a range of types and sizes up to 20 tons. Write for literature... and for recommendations to meet your particular needs.

### *Ransome* WELDING POSITIONERS

INDUSTRIAL DIVISION • RANSOME MACHINERY COMPANY • DUNELLEN, NEW JERSEY

## New German Marine Engine

(Continued from page 19)

bronze bearings, a similar type of metal being used for the wrist-pin bearings. Pistons are of silicon aluminum alloy and cylinder liners of a special cast iron. The liners are free to expand, downwards, and contain ports for the scavenging air and the exhaust gases. The blower has a diameter of 420 mm and is geared up to run at eleven times crankshaft speed; at full speed 9000 cubic meters of air is delivered against a pressure of 0.22 atmospheres.

Fresh-water cooling is employed and a small amount of anti-corrosion oil is used. Parts particularly liable to corrosion are sprayed with zinc for protective purposes. Pyrometers are provided for determining exhaust gas temperatures, with distant indicators at the control panel. In order that the engine may operate through a range of speeds from 100 to 700 rpm, a vibration damper is embodied and is said to diminish the effect of vibrations of the ninth and twelfth orders. The severe critical of the sixth order is stated to lie well above the highest running speed.

The graph on page 19 presents the

results of the trials and shows the relation between speed, power and fuel consumption. The lubricating oil consumption is 0.0044 lb per bhp-hr at full load, which is considered reasonably low for an engine of this kind. The minimum fuel consumption is 0.35 lb per bhp-hr, a low figure in view of the fact that the engine drives all the necessary pumps and is of the two-stroke type. It will be seen that this fuel consumption is secured at a speed of between 410 and 480 rpm with an output of about 1200 bhp.

Commenting on this graph, *The Motor Ship* remarks: "The method of designating the fuel consumption in relation to power and revolutions, as indicated on the curves, is interesting and illuminating. The curve of the turning moment is obtained through the loading as a result of setting the fuel injection pumps for maximum delivery. The propeller curve gives the range of service for a free-running ship with screw propulsion. For the performance of the ship in towing, for instance, the area between the darker lines affords the necessary information."